Standard Size, 9 x 12.

Price, Six Cents.

AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

ISSUED WEEKLY BY THE
AMERICAN MACHINIST PUBLISHING CO.,
256 BROADWAY, NEW YORK.

PUBLIC LIBRARY

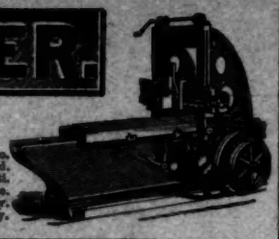
Some Leading Articles in this Number.

Some Special Multiple-Spindle Drills.
Molding Cone Pulleys.
A High-Speed Vertical Engine.
Use of Logarithms.
An Automatic Rim-Drilling Machine.
Alterations on Tracings.
A Belt Accident.
Use of Cross-Section Paper.
Electrotechnics.

NINETEENTH YEAR.

No. 13.
Mar. 26,
1896.

THE GRAY PLANER.



MANUFACTURED BY
THE G. A. GRAY CO.,
CINCINNATI, OHIO.

THE FOLLOWING MACHINERY MERCHANTS CARRY SAMPLES.

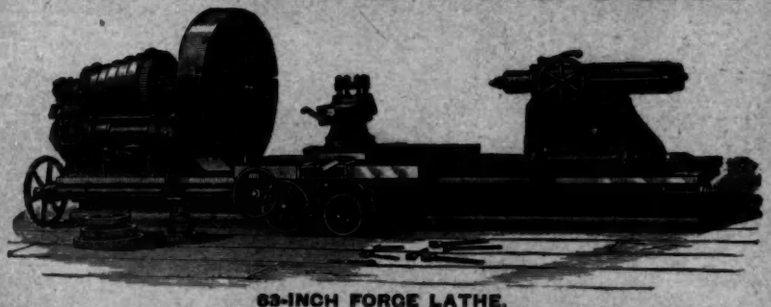
J. A. Fay & Egan Co., ... 24 South Canal Street, Chicago.
Strong, Carlisle & Tarney Co., . . 193 Bank Street, Cleveland.
E. A. Kinney & Co., ... 227 West 4th Street, Cincinnati.
Thos. K. Carey & Bros. Co., . . . 98 Light Street, Baltimore.
J. J. McCabe, ... 14 Day Street, New York City.
Schuchardt & Schutte, . . . Berlin, C., Germany.

THE ACME MACHINERY CO.,

CLEVELAND, OHIO.
Manufacturers of
ACME BOLT & RIVET HEADERS,
Acme Single and Double Automatic
BOLT CUTTERS.
Cutting from 1-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.

P. T. DEC. 4, 1883.
PAT. DEC. 4, 1883.
PAT. AUG. 26, 1884.

MACHINE TOOLS.



63-INCH FORGE LATHE.

THE NILES TOOL WORKS CO.,

HAMILTON, OHIO. Correspondence Solicited.

William Sellers & Co. Incorp. PHILADELPHIA.

HAVE YOU EXAMINED ?

THE NEW TOOL GRINDER No. 2 ?
THE CENTRIFUGAL SAND MIXER ?
THE VICARS' MECHANICAL STOKER ?
THE NEW RESTARTING INJECTOR ?

These may be seen in operation at our establishment.
Descriptive Circulars Mailed on Application.

THE GARVIN MACHINE CO.,

MAKERS OF AND DEALERS IN
METAL-WORKING MACHINERY
OF EVERY KIND.

Universal and Plain Milling Machines, Drill Presses, Screw Machines, Hand and Engine Lathes, Planers, Turret Lathes, Shapers, Gear Cutters, Die and Cutter Grinders, Tapping Machines, etc., etc.

A COMPLETE LINE OF
Special Bicycle Machinery.

WRITE FOR CATALOGUES AND LIST OF NEW AND SECOND-HAND MACHINERY FOR IMMEDIATE DELIVERY.

No. 15 PLAIN, POWER MILLING MACHINE.

Laight and Canal Sts., NEW YORK.
51 North 7th St., PHILADELPHIA, PA.

THE W. P. DAVIS MACHINE CO.

Builders of Fine

ENGINE LATHES,
From 12 to 30 inch swing.

UPRIGHT DRILLS,
From 10 inch Sensitive to 36 in., with B. G. and P. F.

—ALSO—

KEYSEATING and CUTTING-OFF MACHINES

ROCHESTER, N. Y., U. S. A.

Send for Circulars and Photographs.

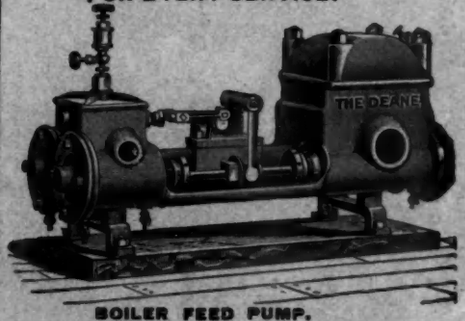
AN X RAY PHOTOGRAPH.

Crooke's Tube adds testimony to the $ in the Flat Turret Lathe. It is the coming type of manufacturing lathe. It cuts the cost without cutting the worker. It combines the convenience of engine lathe with speed and accuracy of a special tool. Special tools seldom required.

Jones & Lamson Machine Co.,

Springfield, Vermont,
Sole Builders and Sole Agents in U. S. A.

THE DEANE
OF HOLYOKE
STEAM PUMPS
FOR EVERY SERVICE.



BOILER FEED PUMP.

DEANE STEAM PUMP CO.,

HOLYOKE, MASS.
NEW YORK. BOSTON. CHICAGO.

AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

Vol. 19, No. 13. WEEKLY. | NEW YORK, THURSDAY, MARCH 26, 1896. | $3.00 Per Annum. Single copies 6 cts.

Copyright 1896, by American Machinist Publishing Company.

For Sale Everywhere by Newsdealers.

Entered at Post Office, New York, as Second Class Matter.

A High-Speed Vertical Engine.

We are enabled to present herewith a half-tone with clear drawings of an interesting engine built by W. D. Forbes & Co., Hoboken, N. J. The engine is of the same general design with the yacht engines built by the above firm, except that the valve motion is not the same. The engine may be commended to the study of those interested in designing and constructing not only steam engines, but machines in general. It may be said to embody legitimate machine work throughout, as all steam engines can scarcely be said to. The easy accessibility of every part of the completed engine is also a notable feature. If it is suggested that the frame is apparently abnormally light, we are assured that it proves amply stiff in operation. The engine shown has been run, in testing, at full speed in the shop, entirely without bolts or braces and with great steadiness.

The engine is 12 x 12 inches, to run at 300 revolutions per minute, and is rated at 70 horse-power, easily developing considerably above that if required. A piston valve is used, the entire cylinder and valve chamber being clothed in asbestos with mahogany lagging outside. The stuffing boxes are unusually deep. The shaft is heavy; the shaft governor consists of two opposite sectors moving out in a straight line and drawn together by long springs, the eccentric being operated by racks attached to and moving with the sectors.

The plan view of this engine, it will be noticed, is not of the same scale as the elevations; the shade lines are also incorrect, on account of some misunderstanding with the engraver.

HIGH SPEED VERTICAL ENGINE.

A Method of Molding Cone Pulleys—II.

BY GEO. O. VAIR.

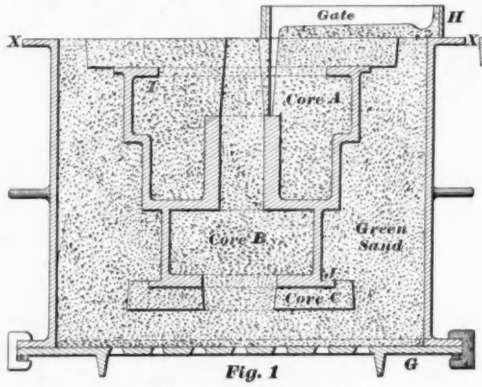
Herewith are drawings, and an explanation of a method of molding cone pulleys, which, as I said in a former article, for simplicity and cheapness, is the best I have seen or practiced up to time of writing.

Fig. 1 is a section of flask and pulley

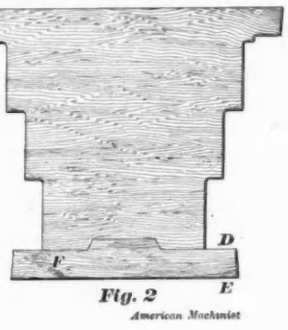
casting. It also shows the three cores *A*, *B* and *C* as they would appear in the mold. Fig. 2 is the cone pulley pattern, made of wood and disjoined at line *D*.

Having placed the pattern on a plain follower board, set the flask on same and proceed to ram up with sand to top of pattern, which would be at *E*. Draw out section of pattern *F*, and put in place core *C* to form bottom flange *J*. The remainder of the flask can then be rammed up, the bottom plate *G* clamped on, and the flask rolled over. The pattern being of wood, it is, of course, very light; consequently, it is unneccessary to clamp the follower board to flask when rolling over, the resistance of the sand retaining the pattern in place.

As core *A* covers the entire casting, ramming up a core would be superfluous. The core *A* can be secured by wedging under a cast-iron bar, clamped to flask flanges *XX*, and core *B*, having a tapered print, is thus safe from "lifting." Runner box *H* is rammed up on a board; and before setting in place a little flour paste is put around the gate, where the runner-box gate connects with the one from hub of pulley. By using a pattern for the runner heads *H*, a boy can ram up enough in a few minutes to do a molder for a day's work.



FLASK WITH PATTERN.

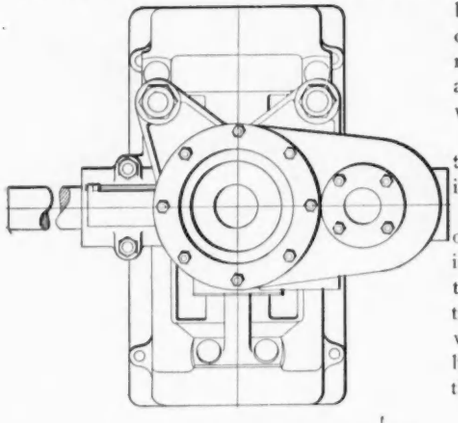


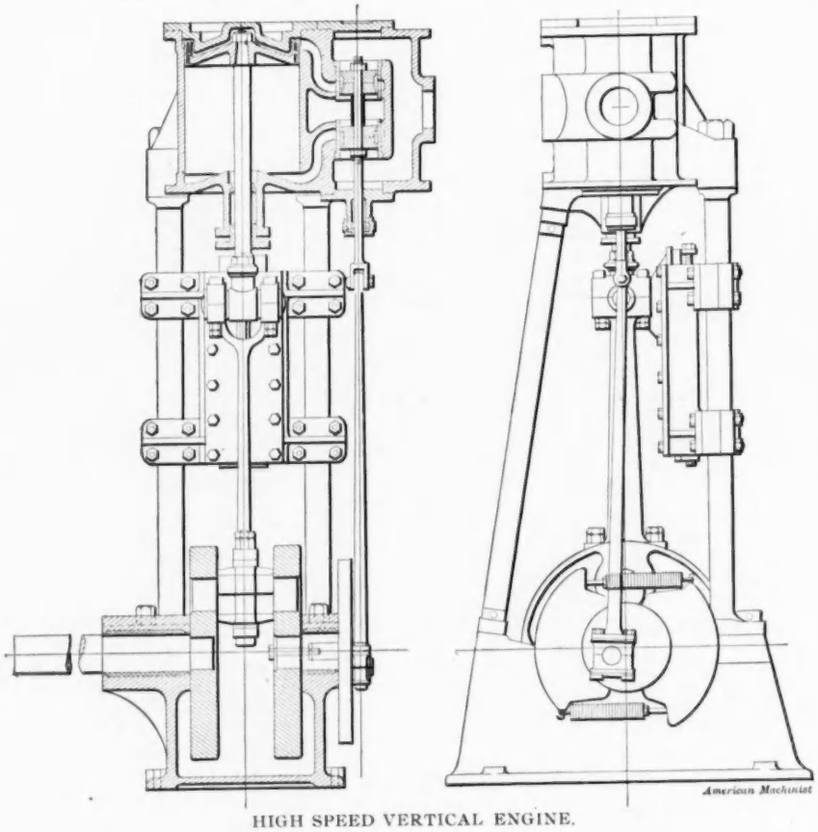
CORE PATTERN.

In making core *A*, a loose flange pattern is needed in the core box to form the inside flange *I* on casting.

Different foundries have different ways of manipulating a flange, as here shown, in a core. Some will have the flange entire, and after ramming the core up to the top of flange, remove it and fill in the vacancy with green sand. Others will have the flange cut in segments, so that they can be withdrawn when the core has been turned over and the core box lifted away.

I think the better plan is to have the flange pattern whole, and, when it is drawn out, drop in segments enough to complete the circle, than ram up the remainder of the core, leaving the segments in until the core is dried If the cores are not exposed to more heat than is needful to dry them, such pieces will last indefinitely, and the slight shrinkage of the wood caused by the drying admits of their being easily taken out. The size of the pulley shown, at its largest diameter, is 12 inches; each step face, 3½ inches.





HIGH SPEED VERTICAL ENGINE.

This method of molding cone pulleys is by no means confined to the smaller sizes, but could be, with slight modifications, successfully practiced on castings of any desired dimensions.

A point that might here be mentioned is, that the cores *A*, *B* and *C* are very plain; therefore can be made rapidly; and any person the least familiar with foundry practice should readily see that a molder will easily make four times as many pulleys with the use of the cores as he would make in green sand. I do not approve of carrying core-making to extremes; but as long as the cost on the core bench is less than it would be on the molding floor, to produce the same results, I would favor the cores.

Frank Kempsmith, of the Kempsmith Machine Tool Co., Milwaukee, Wis., is, as far as I know, the originator of the idea of the hanging core as applied to the molding of cone pulleys. The foundry making Mr. Kempsmith's castings was under my supervision for several years, during which time he used a "shell" pattern, as seen in broken section at Fig. 3, using the pattern for a core box. The extension *O O*, to form the support or print for core *A*, was made of wood and held to place on pattern by small brass cleats *K K*. Fig. 4 shows same pattern with print on, to be used in molding.

In conversation with Mr. Kempsmith lately, he told me that the wooden pattern and core boxes were far superior to the "shell" patterns, not only in regard to pattern cost, but that the foundry pro-

duced better results with the wood pattern. The wood pattern being easy to

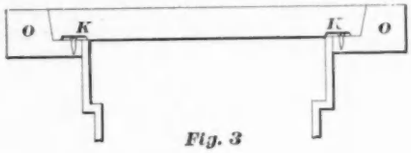


Fig. 3

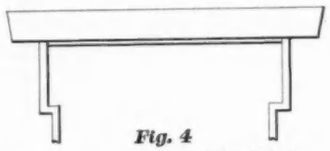


Fig. 4

American Machinist

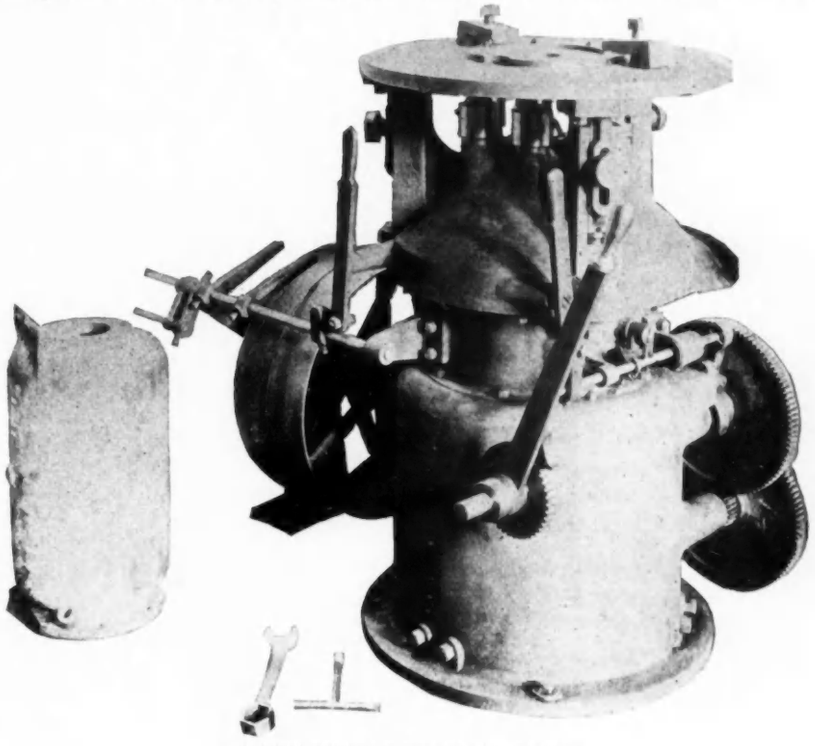
SHELL PATTERN FOR CONE PULLEY.

handle and light to draw, no doubt facilitates the operation.

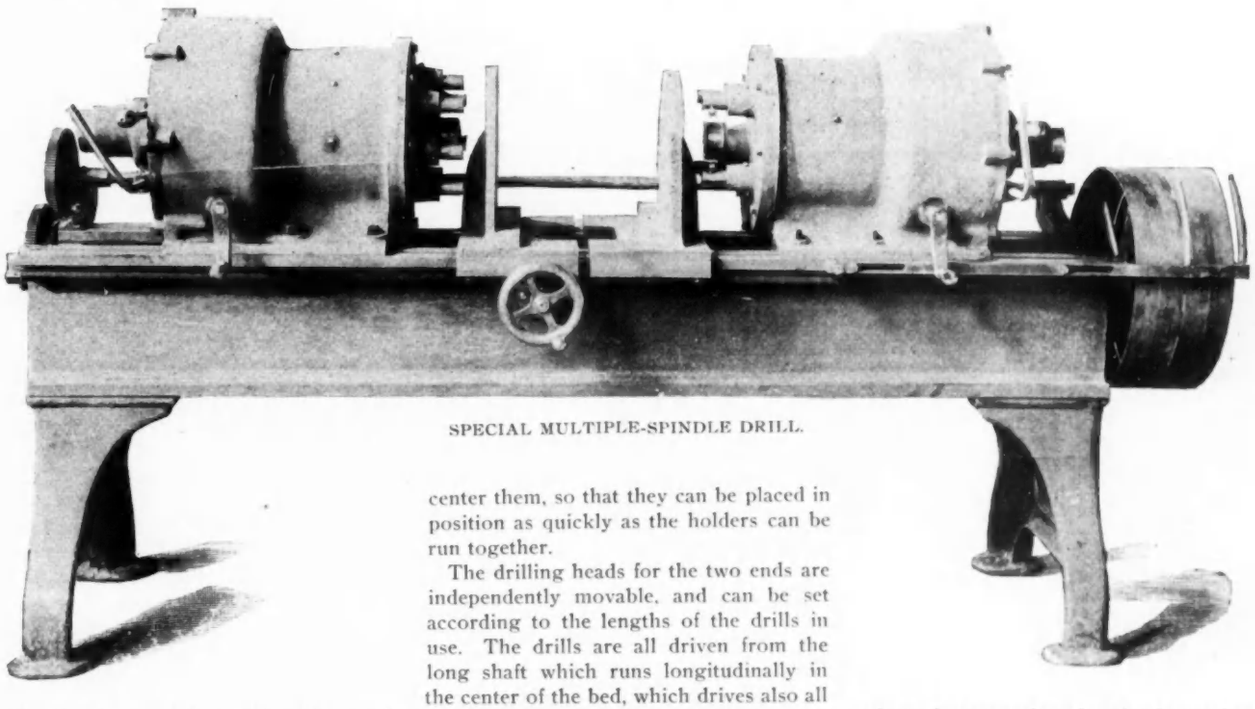
Sharon, Pa.

Two Special Multiple-Spindle Drills.

We take pleasure in reproducing for our readers, photos of two special multiple-spindle drills designed and built by the Pedrick & Ayer Co., of Philadelphia, for the Westinghouse Air-Brake Co., of Pittsburgh. The machines are designed to be used exclusively for drilling the brake cylinders, one of which is shown at the side of the vertical drill. There are four holes to be drilled in one end of the cylinder and seven holes in the other end. These holes are all drilled at the same time by the horizontal machine, while the vertical machine drills only the lower end of the cylinder.



SEVEN SPINDLE VERTICAL DRILL.



SPECIAL MULTIPLE-SPINDLE DRILL.

In the horizontal machine the work holder consists of two angle plates, each gibbed to the bed and moving in opposite directions by means of a right and left screw, opening and closing like vise jaws. The hand wheel by which the screw is operated is shown in the front center of the machine. On the inner face of each of the work holders are placed the templates or jigs for guiding the drills, and on these templates are also projections that go into the ends of the cylinders and center them, so that they can be placed in position as quickly as the holders can be run together.

The drilling heads for the two ends are independently movable, and can be set according to the lengths of the drills in use. The drills are all driven from the long shaft which runs longitudinally in the center of the bed, which drives also all the gearing and feed arrangements, contained in the inclosed heads. The feeding of the drills into the work is done by a disk having the spindles connected to it. On the back of the disk are three circular inclines having friction rollers operated by a worm and wheel, forcing the drills forward, and so arranged that after the holes are drilled the drills are quickly withdrawn. The hand cranks shown on the side or front are for operating quickly by hand, and the bent handles shown at each end are for operating the clutch gearing that drives the feed.

The operation of the machine is simple. The drills being all drawn back, the work holders are opened, the cylinder is placed

on blocks of approximately the right height, the holders are closed by a few turns of the hand wheel, and the cylinder is in correct position and firmly held. The drills are brought up by means of the cranks so that their points come in contact with the work, the feed clutches are thrown in, the drills automatically feed into the work and then reverse ready for another cylinder.

The vertical machine is similar to the horizontal as to driving and feeding the drills, having the automatic return and other features. The top table is adjustable for different lengths of drills, and is raised and lowered by a screw in each of the uprights—all connected by a circular rack with a pinion on each screw.

All the parts of these machines are easily accessible to oil and thoroughly protected from dust. Of the workmanship it is idle to speak.

Electric Welding in England.

The following letter, which we find in the "Mechanical World," London, Eng., gives an interesting account of the practical working of the electric welding process in a shop doing a wide variety of machine forging and repairing:

Sir—Prejudice is a difficult thing to overcome when anything new is introduced in a smiths' shop. There are invariably all kinds of objections and adverse criticisms, and such were raised when the firm in whose employ I am adopted electric welding four years ago. The men seemed timid and afraid to go near the apparatus or touch it in any way, thinking they would get a shock, or even be killed. When, however, they were instructed how to work the welders, and had satisfied themselves that there was no possible danger of receiving a shock, their timidity wore away, and now they make all their piecings or weldings in them with every confidence that each welding they put together is sound, and superior to their former way of scarfing and heating by the smiths' fire. I have worked on the machines myself, and made scores of piecings of different sections, and I can safely say that they are far better, cleaner, and more quickly done than in a smiths' fire. For instance, in the case of 1-inch round iron or steel, we have two youths, rated at 15s. per week each, who will weld twenty-four piecings in an hour the week through, and I know that it is possible to do thirty in a single hour that will stand any reasonable test.

We find the electric welding very useful in cases of breakdowns. Not long ago we had a 2-inch countershaft broken, and with driving and driven it caused about twenty hands to cease work until it was made right again. We took the shaft down, stripped the pulleys from it, pieced it up again in one of our welders, and had the men working again in less than thirty minutes.

One advantage this system has over the ordinary smith's welding is that there is no waste of metal. We can take two pieces of, say, 1½-inch round (iron or steel), saw them each exactly 12 inches long, and when they are welded together and swaged to size they are just 24 inches long. If a steam-engine connecting rod broke we could piece it up exactly the length (without the usual way of making two piecings) and keep it up to the diameter. It would need very little labor in polishing it up again, as every piecing only blackens it about 1 inch on either side of the weld.

We find it very useful in jobs that cannot possibly be done on a smiths' fire—such as articles that are broken too near a shoulder and cannot be heated in a fire without injuring the job; these are easily welded by our welders. We can weld together any size from ⅛ to 2 inches diameter, square or round, and flat bars up to 3 by 1 inch, or any section of the same area.

In cotton mills there are machines named "scutchers," and each machine requires a beater. We make a large number of these machines, and we rivet the knives on the beater arms by using our welders to heat the part that requires riveting. These were formerly riveted cold. The reader will at once see the advantage gained in filling up a ⅞-inch countersunk hole by having it riveted hot, as a rivet of this size when riveted cold is liable to fracture before being thoroughly closed. This is a successful job, as the beater arm cannot be heated in any other way without warping it.

We have riveted together boiler plates and similar jobs by placing the cold rivet in position, applying the current to it, and when sufficiently heated, riveting it up in the usual way.

Every smith knows that it is a difficult job to piece cast tool steel. This is another job that can be done on the welder. We take three pieces of, say, 1¼ square inch planing tools that by frequent visits to the smithy have got too short for use, and generally find their way to the scrap heap. We piece these three together and have a new tool again. Of course, this can be done with other cutting tools that have become too short for the tool box.

When a smith reads this he will wonder, as I did, how a piece of iron could possibly be welded together without fire; and, naturally, if he has not seen an electric welder, he thinks it a new-fangled idea and cannot believe that the piecings will be as sound as he makes them in the usual way. But I can assure him, as a smith, that they are equally as good and will stand a test against any piecings he makes when heated in the fire. The two pieces that are intended to be welded together are not prepared in any way, and roughly-sheared ends or ends cut with the cold set are put together just as soon as if they had been sawn. The installation of an electric-welding plant consists of a dynamo, wire connections, switch and welding machines. The cost of driving the dynamo to transmit the current to the welder, voltage, horse-power required, etc., is not touched on by me, simply because I do not know enough exactly to commit it to paper; but I may say that it is a success in our firm, commercially and financially, and should eventually become extensively used.

JOHN MARSDEN.

Bolton, February 28th.

Making Alterations on Tracings.

An inquiry by a correspondent for a method of obliterating spots made by accidental spattering of water on tracings, leads us to direct attention to the value to draftsmen of a stick of talc, otherwise called "metal-worker's crayon."

There is, so far as we know, no method of entirely obliterating such spots, but they may be largely mitigated by careful rubbing with this crayon. The same treatment is also very helpful for obliterating the effects of erasures by the penknife or eraser. The effect of the crayon is to renew, in a great measure, the original glossy surface, and thereby make it feasible to redraw lines over the surface without danger of the ink spreading by running into the fibers of the cloth. It also overcomes the tendency of such spots to collect dirt, and so become an increasing eyesore as the tracing gets older. Tracings so treated will make blueprints show no, or at most but slight, evidence of the erasures. The crayon should be sharpened to an edge like a drawing pencil, and then carefully and thoroughly rubbed over the erasures or other blemishes. If our draftsmen readers will obtain such a crayon, they will not again be without it. They may be obtained of the D. M. Stewart Mfg. Co., Chattanooga, Tenn., who, so far as we are aware, do not know of this use for their crayons, which are made especially for the use of sheet-iron workers.

A reported sale of 12,000 tons of steel rails by the Illinois Steel Co., to go to Chile, the sale having been made in competition with German and English rail producers, has been attracting considerable attention; and a prominent railroad man, in speaking of the matter the other day, said he believed the explanation of the fact that there is so little "kicking" by American railroad officials against the operations of the steel rail combination here is to be found in the fact that many prominent railroad officials are stockholders in steel rail plants, and personally make more money when rails are high in price than when they are low. Those holders of railroad shares who are not interested in rail plants are out.

Bicycle Tools—XXI.

AN AUTOMATIC RIM DRILLER.

The tool here illustrated was first put before the public at the last Chicago cycle show, and is shown in Figs. 136, 137 and 138. This tool is based on an entirely original conception of rim-drilling method, and embraces so many new features as to become what might seem almost an impossibility to produce, i. e., a really new drilling machine. As such, it is worthy of attention outside its office as a cycle wheel rim tool. Although there seems very little field for drillers of its type in any other line of manufacture, there may, however, be other places in which it is desirable to automatically vary the angle of a drill spindle every time a hole is drilled, and to do this in a regular sequence of changes. In any case, the tool is a mechanical novelty; and unlike many very unusual departures from established practice, it is perfectly suitable for its intended use, and embodies no device not wholly reliable. As noted in previous articles, multiple-spindle machines for this purpose have been devised. At least two spindles are generally thought essential to economical rim drilling, and in some cases more are used.

Perkins found a lot of hampering conditions due to the use of two spindles, and decided to use but one, to automatically change the angle of this spindle for each hole drilled, and to gain his low labor cost by making the machine wholly automatic, both in feeding and indexing. Elaborating these ideas, he produced the driller here shown, which is capable of drilling a 32-hole rim in 40 seconds; one boy can easily attend two of these machines, and also drill the air hole in each rim on a separate driller. In case a very large number of wheel rims are to be drilled, however, the one operator can attend 6 Perkins drillers; and in this case the air-hole drill spindle can be applied to the rim driller and made to drill the air hole automatically, so that one operator can turn out 3,600 rims per day. A single machine and one boy operator can easily drill 700 rims per day, and two machines with one operator would at that rate make 1,400 rims per day.

As shown in the figures, the drill point must stand in a fixed vertical plane when the drilling begins. The scroll chuck is therefore mounted on a pillar slide, and this slide must be adjusted to height for each differing rim diameter; this adjustment is readily made by a rack and pinion, and the chuck slide is secured by two holding bolts in the usual manner. This vertical chuck adjustment is the only actual adjustment which is needed for different sizes of rims, different numbers of spokes, or different hole angles. The machine itself takes care of all those angle and space settings which, with some types of machines, take a good deal of some responsible man's time (usually the foreman's), as this space and angle setting demands more care and more knowledge than the drill operator can usually furnish. The vertical cam shaft *A* is worm-driven from the low-placed countershaft built into the machine. The machine countershaft can be driven directly from the line shaft, but is, of course, better served with an overhead counter of its own. The cam shaft *A* makes one turn to every four holes drilled, and carries one spur gear and two cams, and the spur gear drives two more cams. The chuck indexing is had from a face-stud wheel, or crown-pin wheel *D*;

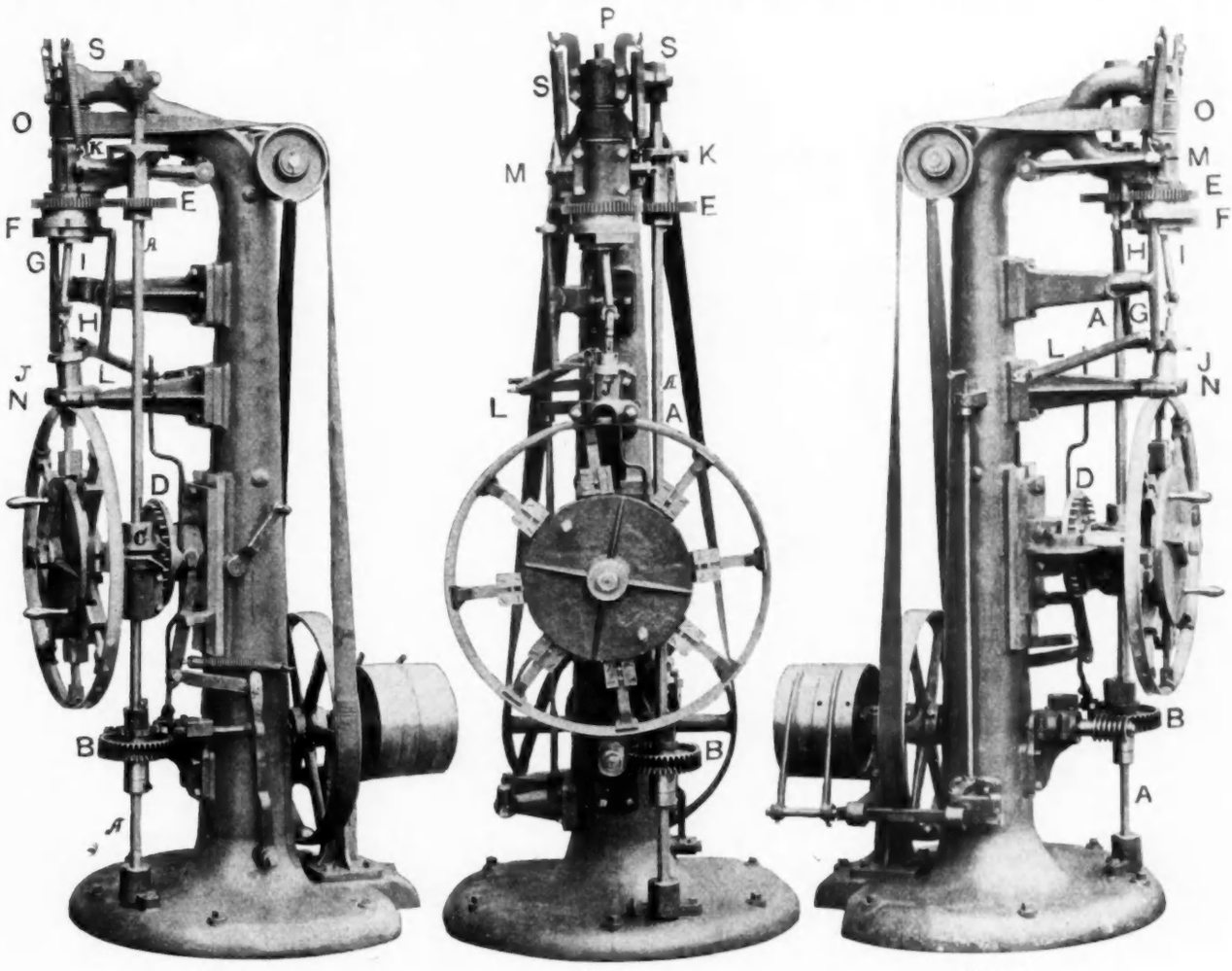


Fig. 136. Fig. 137. Fig. 138.

AUTOMATIC RIM-DRILLING MACHINE.

the pins in *D* engage successively with the 4-stepped cam groove in the cam *C*. This cam has four rises and four dwells; the rises revolve *D*, and the dwells hold it still while drilling is in progress. The spur gear *E* drives the two-cam carrying sleeve *F* even turns with itself, and near the top of the cam shaft is the drill-feed cam *K*, which also has four rises and four dwells. The drill spindle is mounted in a sleeve *J*, which is globe-ended at the bottom, the globe being supported in the globe-bearing bracket *N*, bolted to the drill frame, which is of the hollow goose-neck pillar variety. This makes the drill spindle sleeve *J* capable of universal angular adjustment through a certain range of variations from the perpendicular. To determine the angular position of *J*, two levers *G* and *H*, and a strong coiled spring *L*, are used; *G* and *H* are 90 degrees of a horizontal circle apart at their T lower ends, where they bear against *J*, and have cam rollers on their upper ends and are pivoted near their middle points, and are actuated by two cams—one for each—secured on the cam sleeve *F*, which, as before specified, is driven even turns by the spur gear *E* mounted on the vertical cam shaft *A*. The spiral spring *L* is hooked to the drill spindle sleeve at a point midway between the bearing points of the angle levers *G* and *H*, on the top flange of the spindle sleeve, so that this spring *L* keeps both the angle lever rolls hard up against their respective cams on the cam sleeve *F*. The spindle drive is through a sliding and rotating top member *P*, driven by the belted sleeve, universal-joint-connected to the angle shaft *I*, which is also universal-joint-connected to the top of the drill spindle carried in the variable angle sleeve *J*. *P* has a vertical down-feed action against the influence of the two springs *S S*, obtained through a collar and the rocker-arm-guided yoke *M*, this yoke being actuated by the 4-step cam *K* at the upper end of the cam shaft.

The two sleeve-angle cams on *F* are made with such diameters, rises and falls and dwells as to give *J* its desired angular position, by pushing its top in two directions at right angles to each other against the influence of the spring *L*. These two cams will, of course, vary to suit the particular wheel rim to be drilled; they are easily and quickly changed on *F*, and will always make the same angles in the rim holes. The face-pin index *D* must also be changed for different numbers of rim holes, and this change is also easily and quickly made. The index *D* has a single cam toe on its rear side, which operates a knock-off motion, so that the machine stops automatically as soon as a rim is completely drilled.

The rim chuck is of the scroll variety—suitable without adjustment, to all diameters of rim.

The countersink gaging is from the surface of the rim itself, thus insuring depth uniformity, which could not certainly be had otherwise.

The knock-off action is by no means a necessity, as the actions of the machine are so certain that a rim will go round and round any number of times without the drill touching anything after the first rim revolution is completed.

The specially desirable features of this machine is its ability to make absolutely uniform work, and to duplicate any rim-drilling which it has ever done once. All that is needed is to put the same cams back in the machine, and the same angles will always be given to the nipple holes. The spacing of the holes is also always correct.

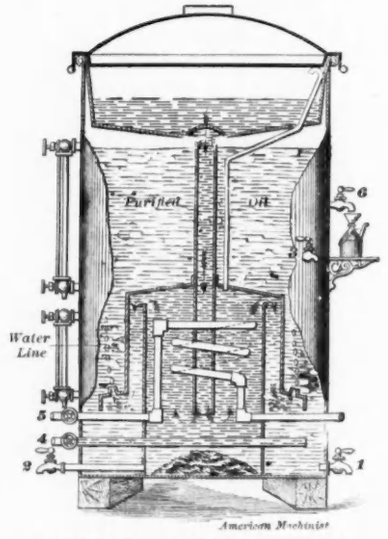
Mr. Willis J. Perkins, the designer of this machine, says that no cycle wheel rim so drilled that "the spokes stand at as many different angles as the quills in a porcupine's back" can be justly ranked as high-grade work, and this remark must be accepted as correct; and his machine is unquestionably a step towards the perfect cycle, because it not only can drill a wheel rim correctly, but it absolutely cannot produce a badly-drilled rim after it has once been fitted with cams to drill that rim as it should be drilled. The machine removes the element of uncertainty from the operation of rim-drilling.

Perkins & Co., of Grand Rapids, Mich., built this machine for use in their own "Souvenir" Cycle Factory, but do not, I believe, intend to confine its field of usefulness to that factory alone.

HUGH DOLNAR.

A New Oil Purifier.

The Q. & C. Co., Chicago, are introducing an oil purifier which is entirely different in action from the familiar oil filters, of which there is a great variety. No



THE PERFECTION OIL PURIFIER.

filtering material is employed in their apparatus, and, consequently, the nuisance of renewal of such material is avoided. In the Q. & C. Perfection oil purifier the oil circulates through a body of water, and is thoroughly purified by that means. The water may be heated to a suitable temperature by a steam pipe, for which a connection is provided. Gages at the side of the apparatus show the hight both of water and oil at all times. The entire interior of the tank may be removed for cleaning, which should not be required more than once or twice a year. The purifier is made in several sizes and styles.

When Greek Meets Greek.

When troops are to be transported by rail, and the high and mighty army officers come into contact with railroad men, it sometimes seems for a time as though the irresistible force had finally met the immovable body.

The well-known locomotive engineer, John Alexander, was once pulling a train on which a body of cavalry was being transported to a Western fort "in a hurry." The horses were being loaded, and a lieutenant, or something, strapped to a saber bigger than he was himself, had been giving orders right and left, evidently under the impression that he was doing a great work. Finally, he turned towards the engine and swung his arms in a mysterious fashion at John. John sat on his cushion like a graven image, and the train moved not.

By regulation military steps the distance to the engine was paced off; and when "himself" came within such distance as he thought would permit him to be properly impressive, he said: "Do you know what the signals mean?"

"I have been accused of it," said John.

"Well, then, I would like to know why you don't back up when I give you the signal?"

"Who the blank are you?" said John. "That little fellow back there with the greasy cap and overalls on is the fellow whose signals I'm watching for; and if I'd pay any attention to you, yourself and your mules would all be killed before you'd get a chance to smell Indians. You go and boss the soldiers."

He went and bossed the soldiers and trainmen until the conductor lost patience and said: "Blankety blank, blank to blank; if you'll go and sit on the fence and keep still, we'll get these horses on the train some time, and if you don't, we never will."

He sat on the fence with his saber across his knees, until the horses were aboard; and many miles of sage-brush were passed before his dignity and self-importance were fully restored.

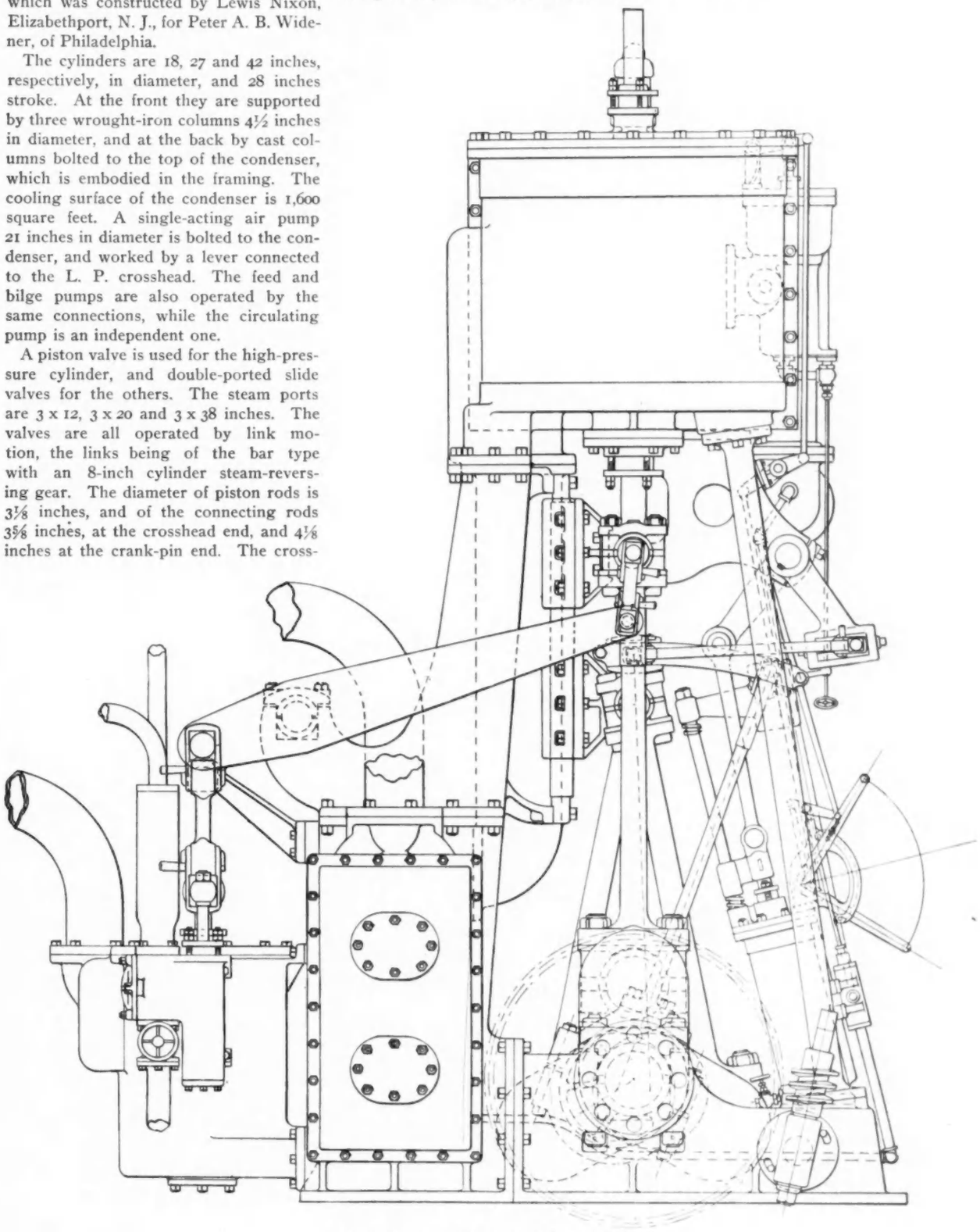
Henry Jarecki, the founder of the Jarecki Manufacturing Co., of Erie, Pa., died on the 11th inst., at Coronado Beach, Santiago, Cal., where he had gone in the hope of improving his health.

Triple-Expansion Engine of Yacht "Josephine."

We present herewith two elevations and plan of a triple-expansion engine designed by John Haug, of Philadelphia, and built by John W. Sullivan, of New York, for the new steel steam yacht "Josephine," which was constructed by Lewis Nixon, Elizabethport, N. J., for Peter A. B. Widener, of Philadelphia.

The cylinders are 18, 27 and 42 inches, respectively, in diameter, and 28 inches stroke. At the front they are supported by three wrought-iron columns 4½ inches in diameter, and at the back by cast columns bolted to the top of the condenser, which is embodied in the framing. The cooling surface of the condenser is 1,600 square feet. A single-acting air pump 21 inches in diameter is bolted to the condenser, and worked by a lever connected to the L. P. crosshead. The feed and bilge pumps are also operated by the same connections, while the circulating pump is an independent one.

A piston valve is used for the high-pressure cylinder, and double-ported slide valves for the others. The steam ports are 3 x 12, 3 x 20 and 3 x 38 inches. The valves are all operated by link motion, the links being of the bar type with an 8-inch cylinder steam-reversing gear. The diameter of piston rods is 3⅛ inches, and of the connecting rods 3⅝ inches, at the crosshead end, and 4⅛ inches at the crank-pin end. The crosshead pins are 4⅝ inches diameter, and the crank pins 8⅜ inches diameter by 9 inches long. Main journals, 8⅝ inches diameter and 12 inches long. The crank webs are 6¼ inches thick and 16½ inches wide. A worm and wheel are used for turning the shaft over by hand, the worm being swung out of gear when not required. The diameter of the propeller is 9 feet 10 inches; pitch, 14 feet. The engine is to develop 1,000 to 1,200 horsepower upon a coal consumption of 1,600 pounds per hour. The reader will please notice that each view of this engine is engraved on a different scale from either of the others.



END ELEVATION OF YACHT ENGINE.

The Use of Logarithms.

In Three Parts—Part II.

It will be seen that the method of using logarithms is quite simple. There is, in fact, more to be learned about taking the logarithms from the tables than about using them after they are obtained. This arises from certain devices being employed to prevent the tables reaching an inconvenient bulk. On this account, taking a logarithm from a table is not as simple a matter as taking the area of a circle from an area table. The matter is, however, purely mechanical and easily learned.

For the purpose of illustration, a short section of a table of logarithms is here included—taken from "Kent's Pocket Book"—which will show everything connected with the use of the tables, except the use of the proportional part table. For this the reader is referred to the "Pocket Book."

It should be noted here that different tables differ slightly in their arrangement of details, but they are usually preceded by directions for their use, so that these differences will not cause embarrassment if the matter is once understood. The tables in "Kent's Pocket Book" are referred to here as being the ones most likely to be accessible to the reader.

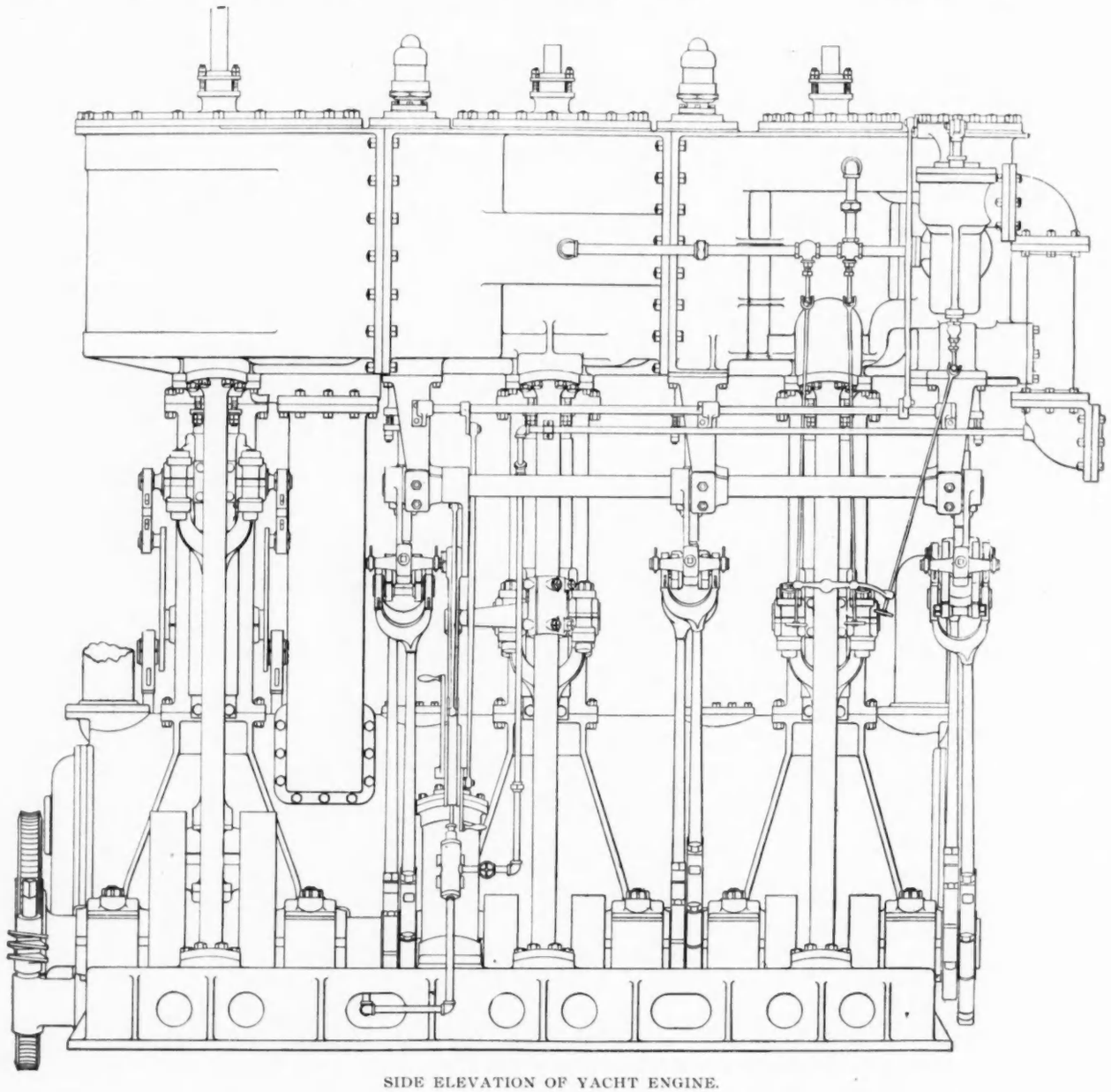
First, it should be said that the logarithm of 1 is 0. This is as it should be. If we multiply 6 by 1 the result is 6, and if we add 0 to the logarithm of 6 the result is still the logarithm of 6. Proceeding, the logarithm of 10 is 1; of 100, 2; of 1,000, 3; of 10,000 4, and so on—the logarithm of any number composed of 1 and ciphers, being a whole number equal to the number of ciphers.

We may see the correctness of this at once. Thus, required the square of 10. As was just stated,

log. 10 = 1.
multiply by 2
giving 2.

which, as was just stated, is the logarithm of 100, and $10^2 = 100$. Again, required the cube of 10:

log. 10 = 1.
multiply by 3
giving 3.



SIDE ELEVATION OF YACHT ENGINE.

which is the logarithm of 1,000, and $10^3_1 = 1{,}000$. Again, multiply 100 by 10:

log. 100 = 2.
add log. 10 = 1.
giving 3.

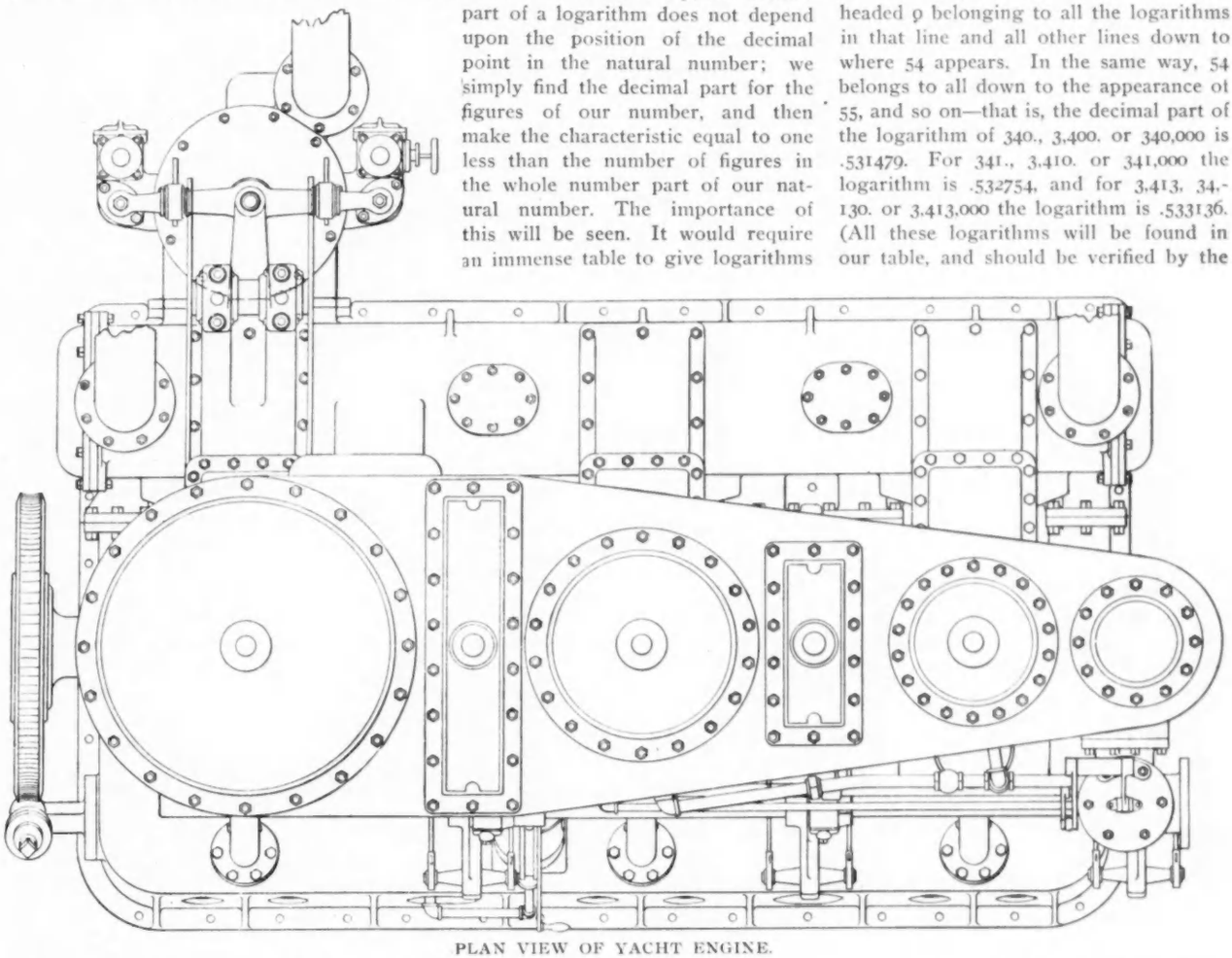
which, again, is the logarithm of 1,000, and $100 \times 10 = 1{,}000$.

Now, all numbers between 1 and 10 have their logarithms between 0 and 1, all numbers between 10 and 100 have their logarithms between 1 and 2, all numbers between 100 and 1,000 have their logarithms between 2 and 3, and so on. That is, all numbers except those composed of 1 followed by ciphers have their logarithms composed of a whole number folfowed by a decimal. The whole number part is called the "characteristic," and is not given in the tables (except in a small table giving the logarithms of numbers up to 100, which usually, though for no good reason precedes the main table). This for the reason that the characteristic is so easily found from what is stated above—that is, the characteristic is equal to one less than the number of figures in the whole number part of the number for which we are finding the logarithm. To illustrate, all numbers between 10 and 99.9+, inclusive (including such numbers as 25.86 or 49.687), have two figures in their whole number part, and the characteristic of their logarithms is 1. Similarly, logarithms of all numbers between 100 and 999.9+have 2 for a characteristic, and between 1,000 and 9,999.9+ they have 3.

Next, it is to be noted that multiplying a number by 10, 100, 1,000, etc., does not change the decimal part of its logarithm. For instance, multiply 389 by 100. Having three figures in our number, the characteristic of its logarithm is 2, and the table gives us for its decimal part .589950; that is,

log. 389 =	2.589950
add log. 100	2.
giving	4.589950

which is the logarithm of 38,900., and does not differ from that of 389. except in its characteristic—that is to say, the decimal part of a logarithm does not depend upon the position of the decimal point in the natural number; we simply find the decimal part for the figures of our number, and then make the characteristic equal to one less than the number of figures in the whole number part of our natural number. The importance of this will be seen. It would require an immense table to give logarithms of numbers up to, say, 1,000,000, and even this would not go as high as would be sometimes required; but by making use of this property, a table reaching from, say, 100 to 9,999, as they usually do, can be used for numbers either larger or smaller than those given in the table.



PLAN VIEW OF YACHT ENGINE.

Now, taking the usual form of table, extending up to 9,999, we observe that we can save nearly one-half the number of columns by having three figures only appear in our column of natural numbers, and writing after it ten columns of logarithms—the first column being headed with 0, and the succeeding columns by 1, 2, 3, 4, 5, 6, 7, 8, 9, successively, as is shown in the short section of such a table given herewith:

If we want the logarithm of 341, 3,410 or 3,410,000 we take the one given in the first column, while if we want the logarithm of 341.3, 3,413. or 341,300. we take that in the column headed by 3 and so on; and in this way we can get the logarithm for any number of 4 significant figures.

Another method of making the table less bulky should be noted here. The two left-hand figures of a logarithm do not change for several lines, and space is saved by writing these two figures in the left-hand column only. This is plainly shown in our table, the figures 53 in column headed 9 belonging to all the logarithms in that line and all other lines down to where 54 appears. In the same way, 54 belongs to all down to the appearance of 55, and so on—that is, the decimal part of the logarithm of 340., 3,400. or 340,000 is .531479. For 341., 3,410. or 341,000 the logarithm is .532754, and for 3,413, 34,130. or 3,413,000 the logarithm is .533136. (All these logarithms will be found in our table, and should be verified by the reader.) Now, this change in the two left-hand figures of the logarithm usually occurs within a line, and is noted in Kent's tables by the insertion of dashes, which are here repeated. Going down the table, we find it in the line for 346, column 8. The logarithm for 3,467 is found as before, and is .539954. These 9's show that we are very near the 54, and, in fact, reach it in the logarithm for 3,468, which is .540079, not .530079. That is to say, when the change occurs, the remaining logarithms of that line are replaced by dashes, and the logarithms are dropped down to show that we must drop down for our first two figures, instead of going up.

One thing more is to be explained, namely, how to proceed in case our natural number has more than four significant figures—that is, in case we wanted

the logarithm of say, 341.36, 3,413.6, 34,136. or 3,413,600. In this case we must adopt another method. We first find the logarithm for the first four figures as before, and then add to it an amount for the fifth figure, which is found as follows: At the right of the table is a column headed "Diff." which gives for each line the difference between the successive logarithms for that line. That is, if we should add this difference for the line in which 3,413 appears to the logarithm for 3,413, we would get the logarithm for 3,414. Now, to get the amount to add to the logarithm of 3,413 in order to get the logarithm of 3,413.6, we must take six-tenths of this difference, and so on—that is, five-tenths if we have 5 in place of 6, or eight-tenths if we should have 8. To illustrate, let us find the logarithm of 341.36. The characteristic, as before, is 2, and the decimal part for 341.3 is, as before, .533136, while the difference for that line is 127.

Section of Table of Logarithms.

N	0	1	2	3	4	5	6	7	8	9	Diff.
340	531479	1607	1734	1862	1990	2117	2245	2372	2500	2627	128.
1	2754	2882	3009	3136	3264	3391	3518	3645	3772	3899	127.
2	4026	4153	4280	4407	4534	4661	4787	4914	5041	5167	127.
3	5294	5421	5547	5674	5800	5927	6053	6180	6306	6432	126.
4	6558	6685	6811	6937	7063	7189	7315	7441	7567	7693	126.
5	7819	7945	8071	8197	8322	8448	8574	8699	8825	8951	126.
6	9076	9202	9327	9452	9578	9703	9829	9954	——	——	
	——	——	——	——	——	——	——	——	0079	0204	125.
7	540329	0455	0580	0705	0830	0955	1080	1205	1330	1454	125.

Now $127 \times .6 = 76.2$

Adding these parts, we have

log. 341.3	=	2.533136
add for	.6	76.2
giving		2.533212

The final 2 carries our logarithm beyond the six figures of the table, and hence is omitted. In the best tables, Kent's included, these proportional parts are given in supplementary tables at the bottom of the pages to save this multiplying; and after finding the difference in the main table, we refer to it in the left-hand column of the proportional part table, and opposite it in the proper column we will find the amount to add. Thus, taking Kent's tables, we shall find in the proportional part table, in line 127, column 6, 76.2, which is the amount found by multiplication in the last illustration. Had our number been 3,413.6 the characteristic would have been 3, and had the number been 3,413,600. the characteristic would have been 6; the decimal part being, of course, the same as for 341.36. If we had another significant figure—for instance, if our number was 341.367, we would multiply the difference by .67, or, using the proportional part table, would add twice —once for .6 and once for .07; thus:

log. 341.3	=	.533136
add for	.6	762
add for	.07	889
giving		.53322109

or, cutting off the two right-hand figures as before, and supplying the characteristic for three figures in the whole number part, we have 2.533221. This correction for a sixth figure is always small and usually neglected, five figures only being taken from the natural number in consulting a six-figure table. The more places supplied by the table, the more are used from the natural number. It is very easy to magnify the importance of the error involved in neglecting the right-hand figures, especially if the numbers are large; but a moment's consideration will show that the largest possible error introduced by neglecting all after the fifth figure of the natural number is less than one-hundredth of one per cent., so that no error of any practical importance would be involved in ignoring all figures after the fifth, or even the fourth.

C. K. Jackson.

A more or less steady acceleration of speed between this city and Philadelphia, Baltimore and Washington has been going on for years, and the time to Philadelphia, both by the Pennsylvania and by the "Royal Blue Line," is now 1 hour 45 minutes. The distance being 90 miles, gives an average speed of 51.42 miles per hour, including stops and slow-downs, and probably involves a maximum running speed approaching close to 80 miles per hour for a portion of the distance.

The "Electrical World" publishes an open letter to Professor Rontgen, asking for information as to the application of his great discovery, so as to get an "X-raise" out of the writer's boss. He even intimates that, in view of his salary being $9.50 per week, a V-raise would be acceptable.

The Tests of Motocycles at Chicago.

In connection with the motocycle contest which occurred at Chicago on Thanksgiving Day of last year, and a full account of which we published in due course, a committee, taking advantage of the assemblage of machines of various types, went into quite a thorough investigation of the relative powers and advantages of each, and their report has just appeared.

The first point investigated was as to the power developed, and the cost of it. In connection with the report, the following table of actual horse-powers from Trautwine was used as a basis of comparison:

Miles per Hour.	Pull or Traction.
Three-fourths	333.3
One	250
One and one-fourth	200
One and one-half	166.6
One and three-fourths	142.8
Two	125
Two and one-fourth	111.1
Two and one-half	100
Two and three-fourths	90.9
Three	83.3
Three and one-half	71.4
Four	62.5

In this table the strength of the horse is assumed at 22,000 foot-pounds per minute, and to be the same at either of the speeds given, the tension decreasing as the speed increases.

In the traction tests of the motocycles it was found that no motor was able to slip the driving wheels, the pull being in every case limited by the weakness of the motion, or more frequently of the reducing gear or connections, the belts slipping or the chains breaking in several instances, so that the results cannot be considered final. The electrical vehicles were limited by the heating effects of the excessive currents.

A wide difference was noted in the consumption of gasoline, the engines using the Otto cycle showing a much higher economy than those giving an explosion for every revolution. The exhaust from the engines of the latter type was so laden with unconsumed carbon that an exhaust pipe and fume blast were required to keep the testing room clear. As with all gas engines, the economy ran low with light loads, and this, in connection with the high friction losses in all the machines, made the resulting fuel consumption very high. Under the best conditions of load, a horse-power can be produced at the rim of the wheel with one-fourth the rate of consumption of gasoline that it can under the worst conditions. A motocycle may ascend a considerable grade at the same speed as upon the level, and with the same consumption of gasoline, or the loading of the engine may increase the efficiency as fast as it increases the load.

The trials showed that the control of speeds is far from satisfactory. In the Benz type of vehicle two ranges of speed were provided for in the mechanism, and minor variations were secured by varying the mixture of air and gasoline, thus securing a reasonably wide range of speeds, but with varying economy.

The vibration of the vehicles due to the piston action was quite noticeable, the single cylinder engines being the worst; the two cylinder motors, with the cylinders at opposite sides of the crank shaft, being much better in this respect.

Whether for business or for pleasure, the motocycle does not yet seem to be all that is desired. The above three particulars—the power or fuel economy, the control of speeds, and the freedom from jolt or vibration—seem to be those upon which the future development of the vehicle must depend. Thus far it can only be safely said that there is much to encourage the inventor and designer to work, and the public to hope, with a full assurance that both will be ultimately satisfied.

The accompanying tables, which we reproduce, will be found of interest.

Death of a Naval Engineer.

Chief Engineer A. S. Greene, of the United States Navy (retired), died recently in Washington. He was graduated from the Rensselaer Polytechnic Institute in the Class of 1859, and was appointed Third Assistant Engineer in 1860. He was promoted twice during the War, becoming First Assistant Engineer in 1864, and Chief Engineer in 1870. He was senior member of many boards for trials and experiments; was on the "Vandalia" during the Samoan hurricane, when the vessel was lost, remaining on duty in the engine room until the vessel struck, and was washed overboard with four other officers who were drowned. He was in charge of the construction of the Government water works at Hot Springs, Ark., 1891-2, retiring in August, 1893, after thirty-three years of active service.

The Association of American Draftsmen has filed articles of incorporation in Washington, the following-named persons being the incorporators, viz.: W. T. Jones, Sidney I. Besseleine, Geo. P. Frothingham, W. T. Powell, A. M. P. Maschmayer and Arthur B. Cassidy. The objects of the organization will be the promotion of practical and scientific knowledge of mechanical drawing and matters pertaining thereto, and to discourage by lawful means the employment of foreign to the detriment of American talent.

DETAILS AND DIMENSIONS OF MOTOCYCLES.

MOTOCYCLE.	WEIGHT (light). Driver, Lbs.	Steering, Lbs.	Total, Lbs.	Wheel Base, Inches.	Gage Drivers, Inches.	Gage Steering, Inches.	RADIUS (compressed.) Drivers, Inches.	Steering, Inches.	Position of Drivers.	Nature of Tires.	Nature of Bearing.	Fuel or Energy Supplied.	Number of Cylinders.	Diam. Bore Cylinder, Inches.	Stroke of Piston, Inches.
De La Vergne R. M. Co., New York..... (Benz Motor).	1,250	430	1,680	66 7	....	....	23.7	18.2	Rear	Solid Rubber	Roller	Gasoline	1	5.12	6.62
Duryea Motor Wagon Co., Springfield, Mass.. (Own Motor).	729	479	1,208	57.5	55	53.7	22.8	18.7	Rear	Pneumatic	.....	Gasoline	2	4	4.5
Haynes & Apperson, Kokomo, Ind..... (Own Motor).	829	421	1,250	54	55.2	55.5	17.8	17.9	Rear	Pneumatic	Ball	Gasoline	2	4	4
Lewis, G. W., Chicago, Ill..... (Own Motor).	900	780	1,680	56	46.6	46.5	22.9	16.7	Rear	Solid Rubber	Roller	Gasoline	1	5	5
Macy, R. H., & Co., New York..... (Roger-Benz Motor).	1,440	385	1,825	67	52	52	23.8	17.9	Rear	Solid Rubber	Roller	Gasoline	1	5	7
Morris and Salom, Philadelphia..... (Lundell Motor).	1,260	390	1,650	49	44.2	36.1	19.8	14.2	Front	Pneumatic	Ball	Storage Battery	Two motors	....	....
Mueller, H., & Sons, Decatur, Ill..... (Mueller-Benz Motor).	1,251	385	1,636	73	50.2	47.8	24	18 4	Rear	Solid Rubber	Roller	Gasoline	1	5.5	6.25
Sturges Electric Motocycle Co., Chicago, Ill... (Lundell Motor).	2,085	1,450	3,535	65	57	57	25.1	23.2	Rear	Solid Rubber	Plain	Storage Battery	One motor	....	....

POWER AND DUTY TESTS OF MOTOCYCLES.

MOTOCYCLE.	No. of Run.	Speed in feet per Minute.	Pull Exerted, Pounds	Horse Power Exerted at Rim of Wheel.	Horse Power consumed in Mechanism.	Total Horse Power developed in Cylinder.	Mechanical efficiency.	Gasoline—Pounds Consumed per Hour.	Gasoline—Pounds Consumed per Horse-Power Hour at Rim of Wheel.	Foot Pounds at Rim of Wheel per Pound of Gasoline.	Cost per Horse-Power Hour at Rim of Wheel—Cents	Efficiency. H. P. Output, H. P. Input.	Heaviest Pull Exerted. Pounds	REMARKS.
De La Vergne R. M. Co., New York. (Benz Motor).	1	619	37	.70	.71	1.41	.50	3.24	4.63	428,000	9.26		162	
	2	1,000	51.8	1.57	1.40	2.97	.53	4.45	2.83	700,000	5.66			
Duryea Motor Wagon Co., Springfield, Mass. (Own Motor).	1	432	83.8	1.10	.59	1.69	.65	4.01	3.64	545,000	7.28		187	Trouble with igniter.
	2	434	88.5	1.16	.59	1.75	.65	3.78	3.24	623,000	6.48			
Haynes & Apperson, Kokomo, Ind. (Own Motor).	1	376	23.1	.26	.61	.87	.30	5.78	21.8	91,000	43 60		119	Two Cylinders in use—one only supplying power.
	2	796	39.3	.95	1.28	2 23	.43	5.75	6.04	327,000	12.08			
Lewis, G. W., Chicago, Ill. (Own Motor).	1	353	49.9	.53	.53	1.06	.50	3.29	6.20	319,000	12.40		109	Chain broke.
	2	491	17	.25	.65	.90	.28	3 28	12.8	155,000	25.60			
Macy, R. H. & Co., New York. (Roger-Benz Motor).	1	521	52.1	.83	1.48	2 31	.36	3.22	3.90	515,000	7.80		123.7	Belt slipped.
	2	945	87.2	2.50	2.68	5.18	.48	4.90	1.96	1,010,000	3.92			
Mueller, H., & Sons, Decatur, Ill. (Mueller-Benz Motor).	1	423	92 1	1.18	61	1.79	.66	3.50	2.96	669,000	5 92		135 4	
	2	540	42.3	.69	.77	1.46	.47	3.87	5.60	354,000	11.20			
	3	564	38.6	.66	.81	1.47	.45	3.77	5.71	347,000	11.42			
	4	584	73.4	2.18	1.57	3.75	.58	3.40	1.57	1,268,000	3.14			
	5	1,168	34.7	1 23	1.86	3.09	.40	4.15	3.37	588,000	6.74			
						Total H. P. developed in Motor.		Electrical Input H. P	K. W. Hours Supplied to Batteries per H. P. H. at Rim of Wheeel.	Foot Pounds at Rim of Wheel per K. W. H.				
													INPUT. Volt.	Amp.
Morris & Salom, Philadelphia. (Lundell Motor).	1	1,025	25.5	.78	.34	1.12	.70	1.36	1.74	1,138,000	17.4	.57	97	10.5 Test ended by trouble with bearing.
	2	2,015	29	1.78	.68	2.46	.72	2.90	1.63	1,215,000	16.3	.61	96	22.5
Sturges Electric Motocycle Co., Chicago, Ill. (Lundell Motor).	1	370	41	.41	.21	.62	.66	.99	2.42	818,000	24.2	.41	121	35 21
	2	892	42	1.14	.39	1.53	.74	1.94	1.70	1,165,000	17.0	.59		69 21

ELECTRICAL MACHINERY.

Electrotechnics—XI.

The Principles of Electricity for Practical Men.

BY FRANK S. MASON.

Each line in Figs. 31 and 32, and also in Fig. 34, following, represents the variation in the volume of the magnetic flux, due to different magneto-motive forces *H* acting upon the particular medium constituting the magnetic path, and shows clearly that in the case of iron a choking effect results from any attempt to overcrowd its capacity.

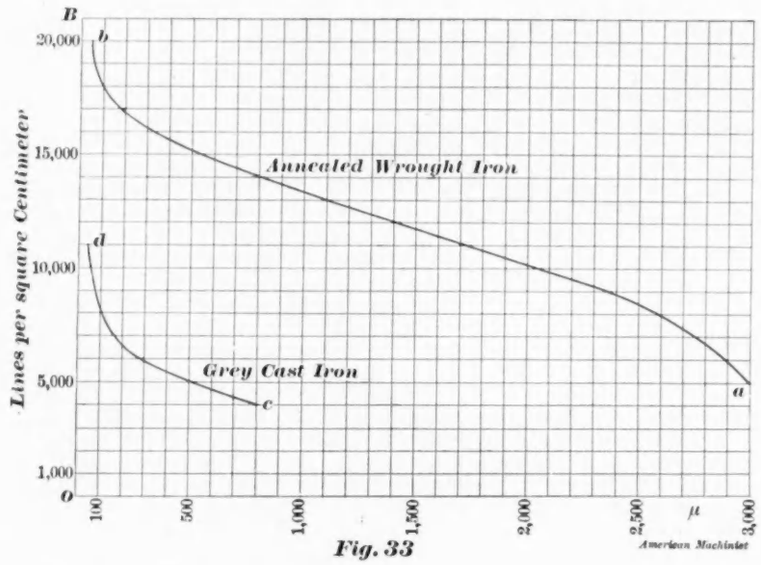


Fig. 33

The lines in Fig. 33 represent this variation in the ratio of *B* to *H*, with different values of *B;* or, in other words, represent the decrease in the magnetic multiplying power of two particular specimens of iron with the increase of the magnetic flux *B*, which flux, as we know, results from the different values of the magneto-motive force *H*.

Owing to the fact that the present state of the art is of recent development, almost every writer has a different way of expressing the ideas involved in *B*, *H* and μ. This renders a clear definition a difficult matter, since the same words are used with different meanings, and the same ideas are expressed in different words, as follows:

B—The magnetic flux per unit of area;
The flux density;
The internal magnetization;
The magnetic induction;
The induction;
The intensity of the induction;
The permeation;
The number of lines per square centimeter in the material.

H—The magneto-motive force per unit of length, expressed by the resulting magnetic flux per unit of area in air;
The magnetizing force at a point;
The magnetic force at a point;
The intensity of the magnetic force;
The number of lines per square centimeter there would be in air;
The intensity of the force in the field;
The intensity of the field.

μ—The ratio of *B* to *H*, or the permeability;
The magnetic permeability;
The specific conductivity for magnetic lines;
The magnetic multiplying power of the material.

In these notes the first-given definition in each case is preferred.

In order to show at a glance the various permeabilities of different steels and irons, the diagram in Fig. 34 is introduced, in which

a is soft-annealed wrought iron;
b is mild steel low in carbon;
c is wrought iron hardened by stretching;
d is annealed tool steel, or steel high in carbon;
e is steel high in carbon, hard drawn;
f is cast iron;
g is hardened tool steel.

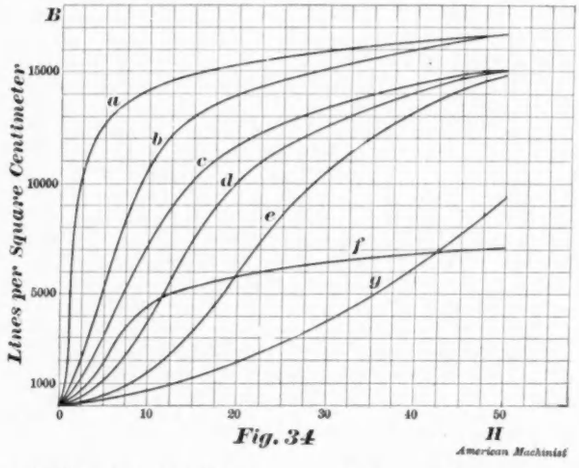


Fig. 34

From this most instructive diagram it is evident that the less carbon an iron contains, and the softer it is, the better it is adapted for use as a core in an electromagnet; and it follows from the latter fact that any treatment to which it may be subjected in the shop, such as rolling, hammering or sudden cooling, which tends to increase its hardness, tends also to decrease its value as a magnet-core material, and requires that it be properly annealed to restore it to its best condition.

The advantage of using an iron of high permeability is twofold: Firstly, the magnet is lighter and less clumsy; secondly, owing to the smaller diameter of the core for the same total magnetic flux, there is a great saving in the amount of copper required in the exciting coils or spirals.

On the other hand, the facility with which cast iron may be shaped by molding, effects a considerable saving in the expense of shop work. In recent years the great advance in the use of casting steel has left cast iron out of the question. In this connection, mention may be made of mitis metal, which is a cast wrought iron, the iron being rendered fluid by adding a small percentage of aluminum.

Magnets are frequently built up from sheet metal in iron or mild steel, when they are termed "laminated."

Arcless Switches.

The "Yale Scientific Monthly" for March contains a very interesting account of experiments made by Mr. A. J. Wurts, looking toward the possibility of making switches which shall not spark when opened. The interesting discovery was made that when static discharges

were made through oil contained in glass tubes, the discharge was accompanied with fracture of the tube.

The explanation given for this effect is that the spark requires space; and the tube being filled with an incompressible liquid, the requirement of room for the spark involves a displacement of the liquid with the suddenness of water hammer. This, in turn, forces the walls of the tube outward; and these being of brittle material, fracture results.

Following up this idea, it was reasoned that if the vessel were stronger than the electro-motive force, it would prevent the expansion of the fluid and passage of the spark. A 100-ampere switch was then inclosed in an iron vessel filled with oil. When the switch was opened, with the stopper of the vessel removed, a column of oil six feet high spurted into the air. In order to see what was going on, a heavy glass front was fitted to the vessel. With this arrangement, a spark about the size of a pea was observed under circumstances which, had the switch been opened in air, would have resulted in an arc about three inches long. After about a dozen breaks of the current, the glass front was shattered as though struck with a hammer. Considerable gas accumulated from the decomposition of the oil by the sparks, and means were then adopted to relieve this and at the same time keep the vessel full of oil. Three thousand breaks were then made, with the result that the oil became carbonized to such an extent as to cause a considerable leakage of current when the switch was open. Glycerine was then tried, and with it 40,000 breaks were made, the result being a slight scarring of the switch terminals, and carbonization of the glycerine until it became black—the leakage with open switch being, however, but a small fraction of an ampere. In spite, however, of the vessel having the best fittings procurable, it leaked badly, and further efforts were made by using a liquid of greater density, namely, a mixture of precipitated silica and glycerine. With this mixture, satisfactory tests were made.

While the experiments have not passed the laboratory stage, they open up very interesting possibilities on a question which has become of no small importance.

Electric Traction on Railroads.

The "Electrical Engineer" for February 19th and 26th contains an article by our contributor, Mr. Wm. Baxter, Jr., on the above subject, which is one of the most valuable that we have seen on this topic. Mr. Baxter recognizes that the extreme claims that have been made for electricity in this field cannot be substantiated. The entire article is written in that moderate and well-informed manner with which our readers are familiar in articles from Mr. Baxter's pen, although the elements entering the problem are so many and complex that he does not attempt to consider some of them in figures.

Mr. Baxter's general conclusion is that the advantages of electric traction are not sufficient to justify existing roads in making the change, but that new roads—especially if located so far from coal fields as to make coal relatively expensive to them—would find it the more economical system. We must say, however, that we cannot consider this as proven, owing to the lack of definite figures on many of the factors that enter the problem, as already mentioned.

Electrical Equipment for an Overhead Traveling Crane.

From a paper on the above subject, recently read by Mr. Chas. L. Griffin before the Worcester Polytechnic Institute, we abstract some of the leading points as follows:

To begin with, Mr. Griffin expresses preference for the three-motor system, though without giving many reasons beyond the statement that it is generally preferred, to which statement, however, we think some exceptions might be made.

Mr. Griffin points out that cranes should be installed on circuits of their own—not an independent circuit for each crane, but a general crane circuit independent of lighting circuits. This for the reason that the great variation in demand for current by the crane will inevitably affect the lights and cause them to flicker. The crane load varies from zero to maximum almost instantaneously; and even if the engine governor responds quickly enough, the compounding of the dynamo will not. Further than this, it is considered bad policy to depend upon a single dynamo for two such important services as light and power.

The generator should be compound-wound, and designed to deliver current at 250 volts pressure, giving an allowance of about 12 per cent. drop to 220 volts at the motors. This large allowance is made to provide for the magnetic brakes, which are held off the drums by the current, and consequently absorb current at the time the motors are working. At the same time, as closely uniform speed is not necessary, some fluctuation of voltage at the motor terminals is not objectionable.

It will be seen at once that the variation in demand for current is more sudden with crane than with street-car service even, as with the latter but few motors out of many can be simultaneously thrown on, whereas with a single crane the entire load comes on at once. With several cranes on the same circuit, this would not be liable to happen, although, as the cranes would in all cases be few in number compared with street cars, the percentage of current required for one crane would always be larger than for one car. This feature requires to be met at the generator by a design which does not require shifting of the brushes with change of load, since no automatic regulation of the brushes could be quick enough to prevent vicious sparking.

The service being always intermittent, gives intervals for the generator to cool down, and hence a somewhat smaller generator may be used than one designed for the same output of current during an all-day load.

With a 20-ton crane designed to lift at 12 feet per minute, with 100 feet per minute trolley travel and 225 feet bridge travel, the hoisting motor should be of 25 horse-power, the trolley travel motor of 3 horse-power, and the bridge travel motor of 12 horse-power—these measurements being made in electrical horse-power delivered at the motor terminals. The figures given for the hoisting motor are based on on efficiency of 60 per cent. between current and load, which Mr. Griffin considers can be attained, though reference to the data given in our issue of February 6th will show it to be considerably in excess of what was found at the Baldwin Locomotive Works; and, certainly, the cranes there are of the best construction and design. Since hoisting and bridge travel are likely to be in gear at once, the total power required is about 37 horse-power, or, say, 43 in the generator, to cover line and brake losses and have a small surplus.

Motors which start with the load, and are required to vary in speed with varying loads, are, of course, series-wound. The dirt, oil and heat, together with the severe mechanical conditions of work, require the best possible design and construction of crane motors.

The necessity for accurate control of the load requires a correspondingly complete and reliable motor control, with sub-divisions much finer than in street-car work, for example.

LETTERS FROM PRACTICAL MEN.

Moisture and Melted Lead.

Editor American Machinist:

Anyone who has had any experience in the matter must have a vivid realization of the fact that there is a great difference, not to say a sharp contrast, between the phenomena attending the pouring of water upon melted lead and those attending the pouring of melted lead upon water. The temperature of melted lead seems to be peculiarly favorable for the conversion of water into steam. When the two come together, the action seems to be as quick as the explosion of gunpowder, and the force generated seems to be also comparable. The ancients probably would have said that water and melted lead were

inimical, just as "Nature abhors a vacuum." They certainly have an active tendency to fly from any intimate contact with each other. When Tecumseh, Jr., gets hold of my bullet mold and uses it for pressing snow into ice balls, I am apt to discover that, while the lead has such an antipathy to moisture, it also seems to have quite an affinity for a fellow's eyes Many others at different times have realized this same general principle; and now a fellow comes along and tells us that all this arrangement may be upset by a very simple device. He tells it like this:

"Many mechanics have had their patience sorely tried, when pouring lead around a damp or wet joint, to find it explode, blow out, or scatter from the effects of steam generated by the heat of the lead. The whole trouble may be stopped by putting a piece of resin, the size of the end of a man's thumb, into the ladle and allowing it to melt before pouring."

What I am afraid of in this case is, that if anybody goes to work and tries this scheme, he will be too much ashamed after he finds how much good it doesn't do to say anything about it.

TECUMSEH SWIFT.

Instruction in Drawing — Admission Requirements in Engineering Schools.

Editor American Machinist:

I have just read with great interest the articles on "Mechanical Engineering at Lehigh University," and "High Admission Requirements in Engineering Schools," in your issue of February 13th. All technical educators who draw their inspiration from rubbing up against actual engineering work, instead of deriving their mental pabulum wholly from books, will heartily agree with you as to the soundness of the ideas on which drawing, etc., is taught in the institution referred to. I would, however, like to call your attention to the fact that these ideas are by no means new. When the writer, six years ago, took charge of this department, he promptly abolished the course in shades, shadows and perspective, the making of pictures, the usual agglomeration of osculating circles, etc., and had the student taught from the beginning that a rough sketch on wrapping paper, if provided with the requisite views and sections correctly dimensioned, was worth any number of drawings—which, though beautifully executed as to delineation, were deficient in dimensions, views and arrangement. The student devoted his entire attention for one term to learning how to represent objects (and mechanical objects at that) by lines, rather than how to make an artistic drawing; hence the work was merely penciled in. By the end of the term his hand was trained to rapid and accurate work, and he knew just what was necessary to make a drawing complete. Then, and only then, was he taught to ink in and finish up a drawing, and he would in a few days learn to do this work well. To start a tyro inking in at the beginning of his course, before his hand is trained to delicacy of touch, seems to me a waste of energy, and it is bound to discourage the student. It is also a serious waste of the pupil's time to require him to ink in and finish more than a very small part of the work done in the class of designing.

The third angle was used in all this work. That is the method the engineering public uses, and which all schools should teach. That many do not teach it is, I think, due to a rather slavish adherence to old text-books.

The plan adopted for shop visits has also been long used by others. When the writer was assistant to Professor H. W. Spangler, at the University of Pennsylvania, some years ago, it was there the custom to send the students singly to visit shops, and devote a certain number of class hours to that purpose. The student received formal instructions as to the purpose of his visit; some particular subject was assigned to him, and a written report on it was required. If, for example, a Sellers planer were assigned, the student was ordered to make a detailed study of all the mechanism of the tool, to write up an accurate explanation of all its operations, and to accompany it with a full set of working sketches illustrating clearly every essential part of the design. When a report of this kind is demanded, and the student has no companion at hand to "chin" with, he will certainly acquire valuable information from such visits.

I also heartily agree with you as to the necessity of requiring engineering students to follow a course in a shop. Whether this work had better be done while at school, or in an outside shop, will appear from what follows:

In your discussion of admission requirements, you touch on a matter which has been the subject of deep thought to those educators who look less to their own aggrandizement than to the benefiting of their fellow-men. Unless my experience has deceived me, the end you desire can really be reached; but the solution to the difficulty does not lie in the direction you point out. As this is a matter of vital interest to many, I shall give fully the reasons for this statement.

With the usual arrangement of classes divided up into years, and with a set order of studies, it is wholly impracticable to grant a student credit for shop work done elsewhere, allow him to devote the equivalent time to making up deficiencies, and then put him through the school in the usual length of time. These very deficiencies prevent him from entering the other classes, and, in consequence, his previous course of shop work avails nothing toward shortening his term at school. The student will save time by entering the technical school just as soon as he is old enough, instead of delaying for a course in an outside shop. Few people recognize the essential fact that education is a profession requiring as much study and practical experience as any other high calling. On this account, the first few years spent in a general shop produce very little for the apprentice. The men about him are all busy with their own concerns, and have no time to spend on him, and could not use the time to best advantage if they had it, for they are not trained to give instruction. Proprietors use apprentices rather to make money out of them than to teach them; hence the knowledge acquired under such circumstances is usually a mere aggregation of intellectual scraps, without order or object. If the student would go into a shop at the completion of his technical course, he would undoubtedly do the very best thing for himself, since he would then know the reasons for things, and be able to lay out for himself a plan of procedure which would be fruitful in results. He would stand in the same relation to the first young man as a steam shovel does to a spade. But it is an unfortunate fact that in this country we are all in too great a hurry to earn money; hence, experience shows that only a small percentage of graduates take such a shop course, and it is therefore essential to provide such instruction as a part of their school training. This has a further advantage, that it provides excellent illustration of the work of the class-room, and materially assists in the acquisition of theoretical knowledge. It also, at the very start, puts a damper on the dude who is so high-toned that he abhors "dirty" work, because he is studying a "profession, doncher know."

"Who, by taking thought, can add a cubit to his stature?" and likewise, who, merely through good intentions and industry, can successfully study branches requiring as a preliminary that of which he knows nothing? The thing is wholly impossible. If a stick is just so long, you must lower the top if you let down the bottom, and it is no less true that if you have only a set time in which to teach a man, he must inevitably know less at the end in proportion as he knew less at the beginning of his course. Any educational scheme neglecting this consideration will certainly fail.

EDGAR KIDWELL.

Dep. Mech. & Elec. Eng., Mich. Min. Sch.

[We cannot agree with the writer of the above statement that "it is wholly impracticable to grant a student credit for shop work done elsewhere," and least of all for the reasons given.

Our favorite plan (some may say hobby) would not, of course, connect well with existing schedules; but we can see no reason why a schedule cannot be laid out to follow such a course of preparation as

well as the one now required. It strikes us that the results to be accomplished, and not the preservation of existing schedules, should be the central aim to which all others should yield.—Ed.]

A Forming Tool Difficulty.

Editor American Machinist:

Possibly some of the tool-maker readers of your valuable paper may be able to throw some light on the following:

I made a circular forming tool (Sketch 1) for forming bicycle cone (Sketch 2), and in order to have it hard enough to stand at *a*, Fig. 1, I case-harden in oil, then warm slowly till the temper begins

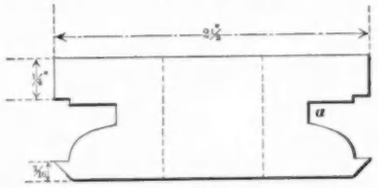
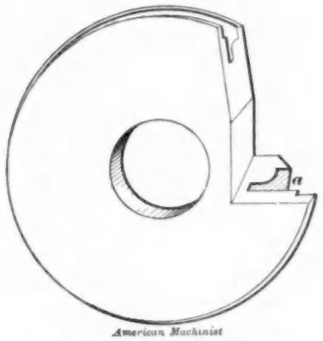


Fig. 1

Fig. 2



A FORMING TOOL.

to draw, then cool in oil. This process has proved satisfactory in nearly all cases, but was a failure in the one referred to above, and I am desirous of knowing why it failed then.

I used the best grade of Jessop's tool steel to make the tool of; and when I came to try it, I found a thin skin of about .010 of an inch in thickness all over the tool, that was as soft as Swedish iron, underneath which it was as hard as one could wish.

Why was it so? What was the cause of the thin, soft outer crust?

H. B. R.

Hartford, Conn.

Logarithms.

Editor American Machinist:

I was particularly struck by Mr. Foote's letter on logarithms, in the "American Machinist" for February 27th, and his suggestion of what you have called "Foote's constant,"or the use of the reciprocal of 3.1416, to be used as a multiplier in ascertaining the diameter of a circle from its known circumference.

There are many of those "short cuts" to save figures, by substituting division for multiplication, and vice versa, which are very simple, such as the division by 2, 3 or 4 if you wish to get 50, 33 or 25 per cent., this method requiring that you watch your decimal points.

The advice in regard to the use of logarithms, however, attracted my attention, because I use and rely on them in making water-power calculations, as saving many figures and insuring more correct results. Take, for instance, the test of a turbine wheel under various openings of gate, in which each change of opening not only varies the discharge of water, but when the flow is reduced usually raises the head acting on the wheel. I set down on one upper corner of my computation paper, as constants, the logarithm of 62.33, the average weight in pounds of water at 60 degrees Fahr., and the logarithm of 33,000. If I want to be very accurate, and the water is much above or below that temperature, I take the weight, as given by Mr. Francis' "Hydraulic Experiments," and use the logarithm of that; then add to this logarithm the one for the number of cubic feet per minute passing the weir, and that of the head, and from the product subtract the logarithm of 33,000, and the result is the logarithm of the horse-power of the water.

Although I once learned the theory of logarithms, I should no more think of calculating one than of making the knife and fork before I eat my dinner. I have used Vega's tables for many years, and refer to them with certainty.

To get the power given by the turbine, I make my apparatus do part of the calculation; that is I make the arms of my Prony brake the radius of a circle of 33, 55 or 66 feet circumference.

Thus, for the 33-foot circle, I multiply the weight in the scale, by the R. P. M., and strike off the decimals, and I have the horse-power. For the 66-foot circle multiply the result by 2, and for the 55-foot circle divide the weight in scale by the number of seconds in making 100 revolutions and add a decimal: These radii are for a 33-foot circle, 5.252 feet; for a 55-foot circle, 8.7535 feet; for a 66-foot circle, 10.504 feet; or 5 feet 3 inches, 8 feet 9 inches and 10 feet 6 inches, respectively, so nearly that the atmospheric changes in the friction of the mill will cause greater uncertainties than the difference from absolute accuracy.

From the logarithm of the power thus obtained subtract the one already found for the power of the water, and the remainder gives the logarithm of the net effect of the turbine.

As the complete test of a wheel usually involves 20 or 30 of these computations, the saving in time, and the greater certainty of accuracy, by using addition and subtraction instead of multiplication and division, may be readily seen, and I am very glad to indorse your recommendation to young engineers to familiarize themselves with the practical use of logarithmic tables, which requires very little practice and renders results much more certain.

SAML. WEBBER.

Charlestown, N. H.

The Cornell Endowment — Students from the Shops.

Editor American Machinist:

It is only that the subject is one of such supreme importance to the State and to every one of its citizens, that I venture to take another line of the space which you have so liberally accorded me already, to straighten the one essential misapprehension in your comments on my letter in the issue of March 5th. It is a not unnatural or unusual one.

The "public funds" of the New York State "Land Grant College," amounting to about $400,000, and giving the university an income of about $20,000 per annum, are the proceeds of the sale of the whole land grant of the State of New York. The State was assigned scrip covering about a million of acres. The States were not allowed to locate their grants, but were obliged to sell the scrip and apply the proceeds in accordance with their contracts with the United States government. New York did this, and at that time, with the market flooded with scrip, could get but little better than nominal prices. Of the million acres of scrip various parties took small portions, and Mr. Cornell, confident that he could safely locate his purchases, took the remainder. The State placed the total proceeds, as above, in its treasury, and for many years did not even carry out the terms of its contract, and did not even pay the five per cent. agreed upon until actually compelled by the verdict of the Supreme Court of the United States.

Mr Cornell held his lands for many years, and even at his death he had actually lost money on them; and his successors in their management, the Trustees of the University, who were authorized to take charge of their sale, only began to get returns of satisfactory amount twenty years after the original purchase of the scrip and the location of his lands by Mr. Cornell. New York State has never, until within the last three or four years, paid a dollar out of the State Treasury for education at its university; it refused for many years to pay its legal obligations, and it has never yet even approximately equalized the account. The original arrangement, agreed to by Mr. Cornell, assigned 125 annual university scholarships to the State. The present law de-

mands 600, and was never agreed to—was simply submitted to by the Trustees; but it measures a forcible seizure, for which no compensation was ever made or pretended to have been made. The State receives, thus, $180,000 worth of instruction, and pays therefor $20,000 annually. Other States have contributed, from their own treasuries, hundreds of thousands of dollars, after paying six and seven per cent. on the U. S. Grant Fund. New York has burdened its university, and has not until recently aided it in the slightest degree.

Referring again to your contention relating to men from the shops, it will be observed that you have printed, not the requirements for that class of men, but those for men seeking something which, from your point of view, is entirely different. All that you ask of the university is already given, as I have shown—except that primary school work is not offered, to any appreciable extent, in this or in any other university.

To this extent I think you are right: I think it would be a beautiful thing could trade schools and schools of the useful arts, of the character that you evidently have in mind, be placed in and beside the university in such manner as to give opportunity for combination of the whole broad college curriculum with theirs, and a great industrial system be thus organized, reaching from highest to lowest. For this I have hoped and pleaded for ten years, and hope some time to see it concrete. But, as matters are now going, the university will have more than it can do in real university work, and the burden thrown on it by the State must be relieved, and still more capital collected to enable all to be accomplished that the Faculty and the friends of the university desire. A "university," however, is not a trade school.

Finally, I may add that, looking back to the time when your ideals were, I judge, most closely approximated, I find the university graduating from three to five men each year in that branch, of whom but a fraction are known, nevertheless, to have come over the road you would have them traverse. To-day, the head of the department of mechanic arts reports about twenty such in the regular graduating class of probably over a hundred, and of these, three are to take the second, the Master's, degree. The fact is, I am confident that, with all the changes of the last ten or fifteen years, no earnest man, such as you would aid, finds any great or insuperable difficulty in getting instruction—perhaps no more than in the olden time; and, happily, now that Cornell University is compelled to restrict herself to the best half of the applicants for the degree in engineering, more of that class of men than ever come to her. The higher her work, and the better the facilities for gaining the best possible education, in technical as well as in other departments, the more men of the most desirable classes come to avail themselves of them.

R. H. THURSTON.

[More could be said in support of our view of the land grant fund, but that subject can have but little interest to most of our readers, and we therefore drop it here by giving Professor Thurston the last word on it.

Regarding the main point of the controversy, either Professor Thurston fails to understand us or we fail to understand him. We do not see how he can claim that the university does not give elementary instruction as long as it maintains a shop in which students without shop experience are given instruction, which, in the nature of the case, must begin with the very rudiments. We cannot see how such work can be considered as less elementary than instruction in advanced algebra and spherical trigonometry. Moreover, the university does give instruction in these subjects to students in other courses, the course in civil engineering containing both algebra and trigonometry.

We have made no reference to trade or industrial schools in this connection, and, in fact, would not have the Sibley College any less a school of engineering than at present. We would simply provide that a boy having shop experience should have it placed to his credit, and then be given the same instruction in algebra and trigonometry as the students in civil engineering, his attainments on graduation being no less than those of his associates who passed up on the mathematics and receive instruction in shop work. In point of fact, he could use his time at the university to still better advantage than his associates. The time occupied by shop work is nine hours per week, equivalent to three hours of recitation, for each of the twelve terms—a total of thirty-six recitation hours. To the mathematics, on which the entering student in mechanical engineering passes up, the civil engineers devote a total of ten hours. In other words, the student offering shop work and taking the same mathematics as the civil engineers, would have twenty-six recitation hours unappropriated. These are equivalent to five hours a week for over five terms, and could be put to splendid use. A part of the time could be devoted to really advanced work in shop practice, for a student who had already served an apprenticeship would have a foundation on which to build something. Modern methods of manufacture, shop administration, methods of cost-keeping and estimating, for example, could be included. In fact, as we study the scheme, it becomes apparent that its effect could be made to raise and not lower the character of the course.

We are at a loss to conceive how Professor Thurston can understand us as having in mind the establishment of trade schools in connection with the university. That course might or might not be a good one, but we have certainly not advocated it. It will, in fact, be observed that, in so far as our plan would remove elementary shop work from the course of study, it would to that extent make the university less a trade school than at present.

So far as the number of students from the shops in the present graduating class is concerned, it does not appear to us as relevant, for the reason that those students entered before the present requirements for admission were established. The student entering now must pass on a year of mathematics in excess of what the present graduating class did.—Ed.]

Filing Tracings in Tubes.

Editor American Machinist:

Since it is my business to place valuable novelties before the readers of the "American Machinist," rather than to join in comment thereon, I have not until now deemed it needful to say anything more in regard to the Gates shops' (Carman's) method of filing tracings than was contained in the original article in your issue of January 16th, and have, consequently, not attempted to defend myself against the inexpressibly painful implied charge of vinous exaltation on my part made by Mr. Wm. L. Chase in the "American Machinist" of January 30th. Indeed, those personally familiar with the lofty ideals which govern the conduct of my private life well know that I need no defense, while those who know me only by my writings must be aware that the exalted reverence for truth which shines in my every sentence could only be held in mental companionship with those noble motives which must dominate one whose only desire it is to increase the knowledge and usefulness and happiness of his fellow-creatures, and incidentally, to receive a fair pecuniary consideration for such self-sacrificing efforts.

But now that Mr. Chase so clearly exhibits in his communication of February 27th a fitting remorse for the stigma he so thoughtlessly (as I am convinced) cast upon gray hairs, the noble generosity of my own nature forces me to say a few words calculated to relieve his mind of the burden of self-reproach under which he is evidently laboring.

No, my young friend; I am seldom intoxicated to an extent sufficient to obscure those brilliantly penetrating perceptive faculties and singularly accurate powers of analysis and comparison with which I am so notably gifted. None of my many friends have ever offered to pay my expenses during a recuperative and prophylactic sojourn with Mr. Keely. And Mr. Chase is evidently not experimentally aware of the effects of internal administra-

tions of alcohol on the human system; were he so informed, he would know that to dine not wisely but too well overnight is not conducive to the excitation of over-laudatory feelings the next morning, but quite the reverse. I know this great truth by experience, myself, and am therefore prepared to speak positively in the matter.

No, Mr. Chase; the only dinner I ever had with the Gates Company officers was presided over by a very neat German woman in second-floor apartments, where we went through the kitchen to reach the dining-room, and each man individually recouped the landlady for his entertainment at the modest price of twenty-five cents per plate.

Mr. Carman is a very intense young man; and as he knows he is right, and Mr. Chase, seemingly another intense young man, knows he is right too, I shall be delighted to see them fight it out—and may the best man win!

For all that, sauce for the goose is sauce for the gander; and it is a poor rule that won't work both ways. Mr. Chase says that a bucket even full of pebbles will yet hold a good deal of added water. Please, Mr. Chase, would not a drawerful of tracings hold a good deal of added water as well?

As to Mr. Tecumseh Swift (why a man with such a name should object to the elision of any part, or even all of it, is more than I can understand, and I long to write "Tecums"—the sibilant Semitic termination seems so odiously redundant). As to Mr. Tecumseh Swift, I say, and his observations in the "American Machinist" of February 13th, I beg to observe that his clause "keeping blueprints rolled in tubes"—blueprints, blueprints, mind you—suggests an experience in localities at least one remove from the drawing-room so vividly to the reader's mind as to rob his drawing-room authority of preponderating weight.

One of the editors of the "American Machinist" informs me he once saw a place where blueprints were preserved by rolling them and sticking them as far as they would go into nail kegs, but he did not say that Mr. Tecumseh Swift was employed at that shop. I would say, however, for Mr. Tecumseh Swift's information, that it is a very common practice not to preserve blueprints, but to let the machinist who uses a blueprint keep it as long as he can read it, and then give him a new one. Where blueprints are preserved, they are commonly mounted on pasteboard and varnished, and fitted with rounded metal corners; and neither Mr. Carman nor myself would recommend rolling a blueprint mounted on heavy pasteboard.

I will here add (and I am distinctly not an example of *in vino veritas* at this moment, although I am telling the truth all the same), that if tracings are filed in drawers they are always liable to injury at the edges and corners, unless kept in folios of heavy paper; and I also assert once more, that Carman's tube method of filing tracings is cheaper, more compact, more convenient, and keeps tracings in better condition than any possible drawer or cabinet system.

I was in Worcester last week, but had no leisure to meet Mr. Chase; I am just now going West as far as Milwaukee, but shall soon be in Worcester again, and shall make it a point to form the acquaintance of so ingenious and rightminded a youth as Mr. Chase's apology of February 27th proves him to be. Meantime I beg that young gentleman not to let the dull shades of remorse dim the lustre of his alabaster brow; we will meet and follow that noble advice of St. Paul to "try all things, and hold fast that which is good"—if we can.

JOHN RANDOL.

A Belt Accident.

Editor American Machinist:

A few weeks ago a belting accident occurred by which one man lost his life, and another had an arm broken and was pretty badly shaken up.

There was a machine composed of a watertight box, two wooden rollers, about 8 inches in diameter, revolving one above the other; the lower one I think, in the water in the box, and driven only by the friction of the upper one. The upper one had on it an 18-inch pulley, about 2-inch face, and was driven by a 2-inch belt directly from the shaft. The shaft was 4 inches in diameter, running at 270 revolutions per minute.

It seems that the man who was killed was a machinist and a general handy man about the works. The man who had his arm broken was only a machine tender. The machinist was assisting a pipe fitter to repair a pipe connection to the machine. After the repairs were made, he suggested that they put on the belt. It had one end hung on a nail, and the other was on the shaft. They took the end of the belt from the nail, and the pipe fitter made several attempts to put it on the pulley; the belt having to run crossed may have been why more than one attempt to put it on the pulley was necessary. However that may be, the man who had his arm broken was watching the proceedings, and finally came to the conclusion that if the belt was held clear of the shaft (the bare shaft was used as a pulley, and there was nothing on the shaft within four feet of the belt on either side), it would go on the pulley better; so he jumped up on a barrel which stood in about the right place, and held the belt (as he stated) clear of the shaft with his right hand—with the hand above the belt, and the belt held between the thumb and fingers. While in this position another attempt was made to put the belt on, and at this moment the man who was killed was standing about half way between the machine and the shaft, watching the man on the barrel.

The man on the barrel said: "They tried to put the belt on while I was holding it, but couldn't make it go. It slipped and caught my hand, and pulled me around the shaft, and I dropped on the floor."

The pipe fitter said: "I was putting the belt on the pulley, and couldn't make it go. It slipped, and the next thing I knew I heard the man who was killed holler: 'For God's sake stop the engine! He is caught on the shaft and will be killed!'" Then he saw the man going around on the shaft; and at the same moment the man who was killed grabbed him by the leg as it came around, and was himself drawn up on the shaft and entangled in the belt, while the other man dropped to the floor. The pipe fitter ran at once to the engine room and had the engine stopped. Just before the shaft came to a standstill, the man dropped to the floor. He lived about an hour after this. The doctor who examined him said the cause of death was fracture of the skull, a fracture of the right leg and left arm, and a compound fracture of the left leg and the right arm.

The verdict of the jury was that the man came to his death in the performance of his duty, and censured the company for not having a man specially employed to attend to the belts.

Now, the questions are: How did the first man get caught by the belt? He was standing on the off or safe side of the shaft, and the belt was running towards him over the top of the shaft. How was it possible for the belt to hold the first man tight enough to lift the second man up on the shaft and catch him in the belt, and at the same time let go of the first man so that he dropped to the floor?

GEO. GUNTZ.

Brooklyn, N. Y.

The Use of Cross-Section Paper.

Editor American Machinist:

Since writing you, indorsing Mr. Foote's statements as to the value and convenience of logarithms, and specifying their application to the calculations which are involved in the measurement of water power and the tests of turbine wheels, I have seen a letter in the "American Machinist" from my son, Mr. Wm. O. Webber, speaking of the great convenience of section paper for workshop use; and as I have made very extensive use of it in the matter of turbine tests, I take the liberty of sending you a diagram, in which the relative economy of water, as given by various turbines, is more clearly shown at a glance than it can be by any study of columns of figures.

On this paper, the vertical lines represent the volume of water used, and the horizontal ones the percentage of effect realized, and curves drawn through the

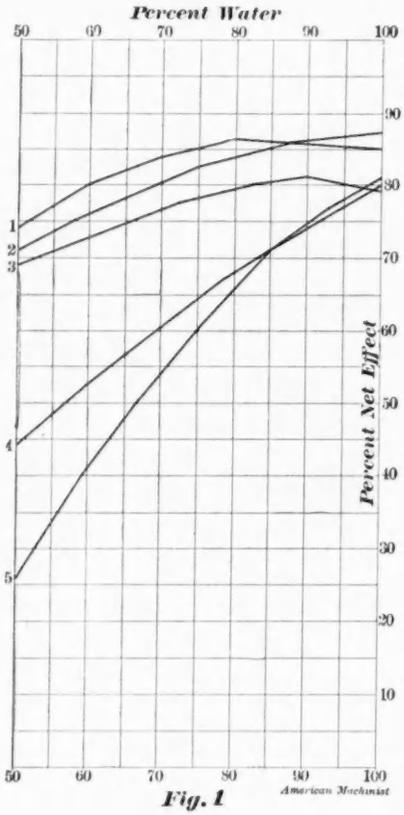


Fig. 1

points ascertained at the trials show very clearly the relative value of the wheels.

In Fig. 1, line 1 represents the test of an exceptional Hercules wheel, the test made by Professor Thurston at Holyoke; line 3, that of an average Hercules wheel, made by myself at the same place; line 2 shows my test of a Risdon wheel at the Centennial Exhibition; line 4 is taken from Mr. Francis' celebrated tests of the Boyden Fourneyron "Tremont Turbine;" and line 5 is my own test of a Houston wheel, in the Holyoke Flume. I think they show very clearly the advantage of section paper for all such purposes.

Fig. 2 is a copy from one made twenty years ago, at the time when great changes were being made in cotton-spinning machinery, and shows the relative consumption of power by the old-fashioned ring spindle, weighing from 10 to 12 ounces, and the new one of from 4 to 6 ounces. These lines are averages from many hundreds of trials, and show that the new spindle required the same power at 8,700 R. P. M. that the old one did at 6,000, and less power at 10,000 R. P. M. than the old one did at 7,000, where it practically ceased to be operative; 6,000 R. P. M. being considered the working limit, while the new ones are now in successful operation at from 9,000 to 10,000 revolutions in many mills. The result has been to increase the production of cotton cloth 50 per cent. with the same power, in the same time.

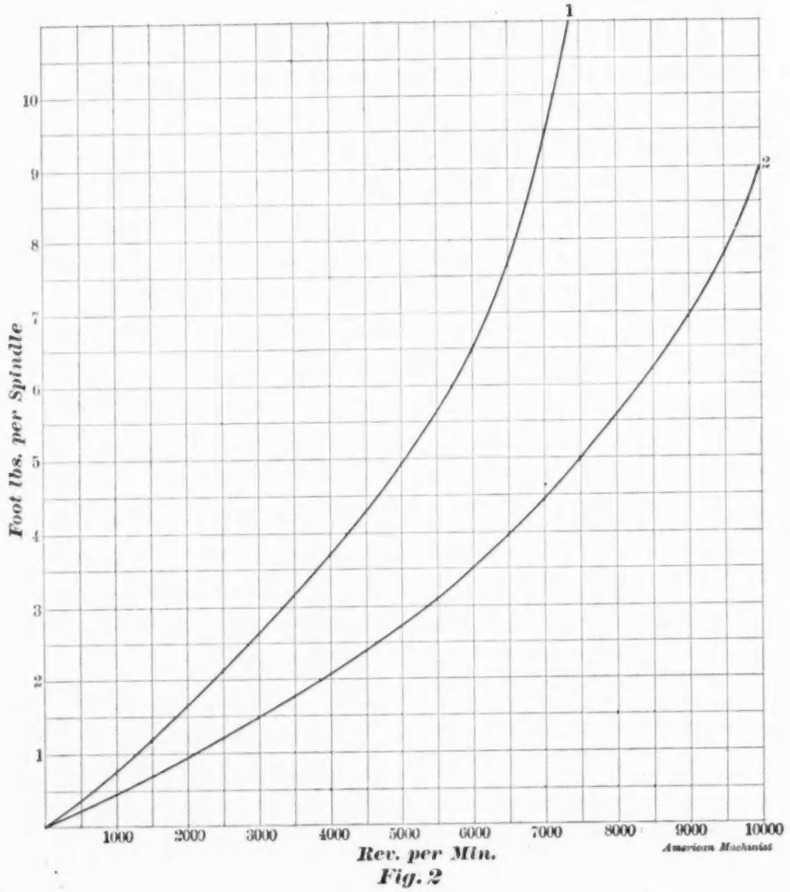


Fig. 2

USES OF CROSS-SECTION PAPER.

I have used hundreds of sheets of section paper for such purposes, getting my supply at first from Queen, of Philadelphia; but I now use that prepared by Professor Carpenter, of Ithaca, which is of a very convenient size, much more so than some of my earlier paper, which I had ruled in inches and tenths. These details may not interest your readers particularly, but they may be of use as suggestions, and I therefore send you them for that purpose.

SAML. WEBBER.

Turning Elliptical Tapers.

Editor American Machinist:

If ingenuity is the one great feature of merit in mechanical invention, then surely all inventions and inventors are not duly appreciated. Foremen of shops, for instance, are frequently surprised at the ingenuity displayed by men and boys in devising ways of doing things wrong. Appreciation in such cases does not follow. So, in reading the alleged mechanical papers, when I come across come of these ingenious misstatements regarding shop operations, I cannot say that I am always entirely lost in wonder and admiration. I picked up the following on a scrap of paper a short time ago:

"It is a well-known fact, which has been repeatedly illustrated and explained in the clearest manner in our mechanical journals, that in turning tapers on a common lathe with set over centers, the track of the tool is oblique to the axial line of the turned piece, and thus produces more or less of the oval form; that is to say, that the piece will not be exactly round, but will have a long and a short diameter."

Of course, this is absurdly untrue, and the so-called explanation with which it was supplemented was of the same piece. It is possible to turn a piece taper and at the same time oval, but it is doubtful if the writer of the above-quoted paragraph could tell a fellow how to do it.

If a piece was placed upon the centers with the lathe set for straight or parallel turning, and was firmly held in that position without revolving, and if then a tool was made to revolve around the piece in a circular path at right angles to the center line, or to the axis of the piece, and if the tool projected inward enough to cut the piece, it would turn a round place on it. If the tool continued to revolve around the piece in the same fixed path, and the piece, without turning, was slowly moved along in a line at right angles to the plane in which the tool was revolving it would be turned round and parallel, or of equal diameter all the way along, as far as the tool continued to revolve and cut. So, if the piece on the centers remained stationary, and the tool, still revolving in a

plane at right angles to the axis of the piece, was also slowly fed along in the direction of the axis, or parallel to the axis, the piece would be turned round the same as before.

If, now, instead of the plane of the revolving cutter being at right angles to the axis of the piece, it revolved at an oblique angle, the point of the tool would for any single revolution still cut a round place upon the piece; but if the piece were fed along in the direction of its axis, the tool would be found to turn the piece oval. Suppose the plane of revolution of the cutter to remain vertical, but to be changed to an oblique angle laterally, then, if the piece were fed along lengthwise, as before, it would measure the full diameter of the circle up and down, but it would measure less horizontally, or would be oval. Beginning, again, with the cutter revolving in a plane oblique to the longitudinal movement of the piece, if the cutter as it revolved could be gradually and slowly drawn outwards as the piece was fed along, the piece would be turned taper as well as oval, and the relative proportions of the two diameters of the oval would be retained, or the oval at any section of the turned piece would always be of the same shape, though of a different size.

The conditions assumed here cannot be readily secured in a common engine lathe. It is, however, easy enough to bore a piece oval within certain limits, upon a lathe. If the piece to be bored is bolted upon the lathe carriage, and if the cutter is on a boring bar mounted on the centers of the lathe, with the centers of the lathe "set over" in the same way as for turning tapers, the piece will be bored oval. It will, of course, also be bored parallel, or of the same dimensions the entire length of the hole, assuming that the tool does not wear.

With a piece revolving upon its axis, or upon centers in the lathe, whether the lathe centers are set over or not, and with a tool in the tool post of the lathe, the piece will be turned round, and not oval, every time. When turning tapers in this way, if the lathe centers are set over considerably, and if the centers in the piece are imperfect, it is possible that the piece may be slack upon the centers at same point of the revolution, and it may wobble more or less, and be slightly out of round on that account; but that would have nothing to do with any theoretical oval, falsely attributed to the obliquity of the axis of the piece with the longitudinal path of the tool.

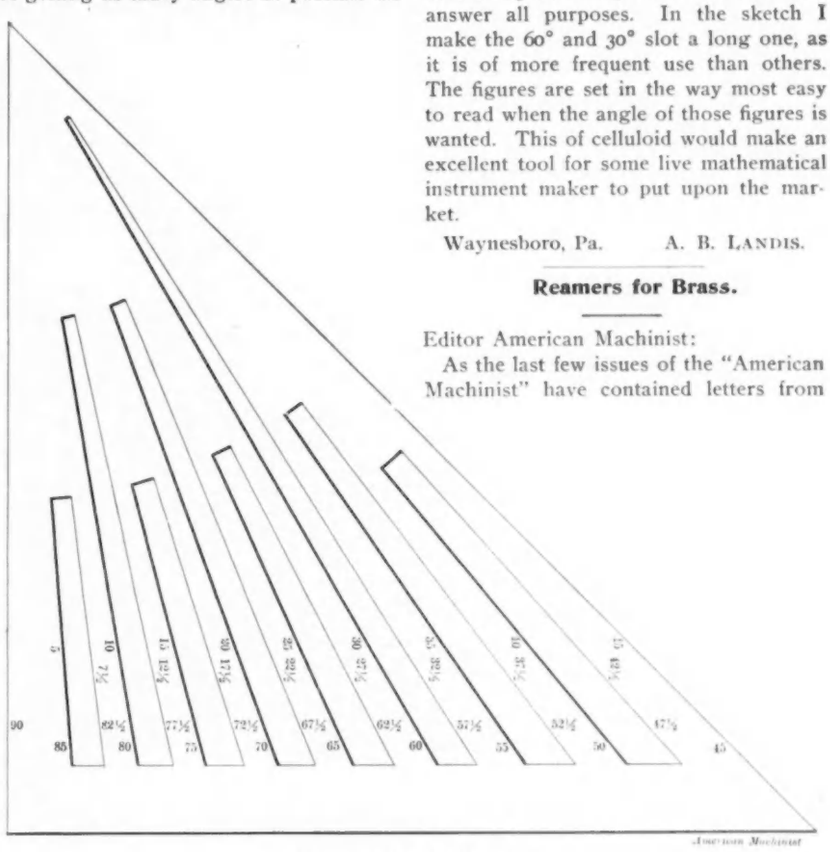
Turning tapers by setting over the centers is not good practice, although still a very common one, and it is all right to condemn it; but in the condemnation nothing is gained by the promulgation of other ideas that are misleading, as in the paragraph which I have quoted. In a lathe which had both a swinging headstock and a swinging foot-stock (and I have seen such a lathe), so that the axes of both spindles would lie in the same straight line, the objection to setting over the tail-stock would disappear, but such a construction would involve more expense, and be perhaps after all less satisfactory, than the now familiar taper attachment. Upon general principles, I am disposed to look with favor upon swing-head lathes, and would be glad to see them more common, but it is not likely that I ever will.

MORRIS FULTON.

Coming Down to One Triangle.

Editor American Machinist:

I have noticed the discussion on the third triangle question, for the purpose of getting as many angles as possible on three, and latterly two triangles. It has been a desire of mine for some time to have triangles by which as many angles could be obtained as possible, but I have never been able to find anything on the market to fill the bill, except the adjustable angle, which is rather expensive. Some time ago I fell upon the plan of a triangle as per the enclosed sketch, which makes only one triangle necessary to get everything that is ordinarily required. This sketch, which is doubtless self-explanatory, I think would meet a long-felt want in this line. It is obvious that more or less angles can be put into the triangle as may be found advantageous. The advantages of this arrangement will be apparent, in that there will be little time lost in finding the angle wanted, as they are all in consecutive order, and the triangle will not need to be turned this way and that until the proper angle is found, as must necessarily be the case with the arrangements you have thus far illustrated. As will be seen, I have all angles by the progression of 5°, and all those between this running by 2½°, except 2½° and 87½°, which could be easily added. If the 2½° progression were not wanted, and the progression of 5° only were wanted, the slots could be made parallel. By staggering the slots so that they do not cut into each other too much, there is no reason why every degree could not be contained in the triangle. The slots, however, in this case would necessarily be short, but would doubtless answer all purposes. In the sketch I make the 60° and 30° slot a long one, as it is of more frequent use than others. The figures are set in the way most easy to read when the angle of those figures is wanted. This of celluloid would make an excellent tool for some live mathematical instrument maker to put upon the market.



ONE TRIANGLE ENOUGH.

Waynesboro, Pa. A. B. LANDIS.

Reamers for Brass.

Editor American Machinist:

As the last few issues of the "American Machinist" have contained letters from practical men in regard to reamers, and none have contained any information in regard to reamers used in brass, I would like to have the following questions answered:

1. What is the best form, spiral or straight flute, especially for reaming cocks?

2. What is the best form of cutter to use for fluting?

3. Should cutting edge point direct to center?

4. If spiral, should the spiral be right or left handed?

5. What is the best method of grinding spiral taper reamers?

P. F. H.

Cleveland, O.

AMERICAN MACHINIST

PUBLISHED EVERY THURSDAY

BY THE

AMERICAN MACHINIST PUBLISHING CO.,

256 BROADWAY, NEW YORK.

ANGUS SINCLAIR, Pres't. JOHN A. HILL, Treas.
C. A. HANSMANN, Sec'y.

C. P. DAY, Manager Adv. Dept.

FRED J. MILLER, Editor.

FRANK RICHARDS,
F. A. HALSEY,
EDWARD P. BUFFET, } Associate Editors.

Special Announcements.

☞ *We publish nothing in our reading columns for pay, or in consideration of advertising patronage. Space in the advertising pages only is for sale.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Every correspondent, in order to secure attention, must give his full name and address; not necessarily for publication, but as a guarantee of good faith.*

☞ *All communications for or relating to the reading columns should be addressed to the editor. All other communications to the company, as above.*

☞ *Subscribers can have their mailing address changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

☞ *The* ***American Machinist*** *is not interested in any particular patents, products or factories, to the prejudice of others, but is devoted to the interests of all those who have to do with designing, building, selling and using machinery.*

Subscription.

$3.00 a year in advance, postage prepaid in the United States, Canada and Mexico.
$4.00 a year to Other Countries, postage prepaid.
Special Club Rates. Write to us for particulars.

Advertising.

20c. to 50c. per line, each insertion, according to space and number of insertions.
Special rates for large space on application.

The American News Company,

New York, is the Publisher's Agent, and dealers are supplied by all its branches throughout the United States and Canada.

For Europe:

THE INTERNATIONAL NEWS COMPANY, BREAM'S BLDGS., Chancery Lane, LONDON, E. C., ENG., will receive subscriptions for the AMERICAN MACHINIST at 16/6 per annum, English currency, or 17 marks per annum, German currency, postpaid.

Subscriptions received in Paris, France, by E. TERQUEM, 31 Boulevard Hausmann, at 21 francs per annum, postpaid. Subscriptions received in AUSTRALIA by W. WILLIAMS, 17 and 21 Fink's Buildings, Melbourne.

Branch Offices:

GERMANY AND AUSTRIA: LEIPZIG.
OSCAR NEUMANN, Waldstrasse 70.

FRANCE: HAVRE.
E. CHENEAU, 246 Rue de Normandie.

The Treatise as a Book of Reference.

Too many authors of technical books fail to appreciate, or at any rate to show their appreciation of the essential differences between a treatise and a book of reference; and a student may thoroughly read a treatise with admiration and satisfaction without realizing its defects as a book of reference, or perhaps himself realizing the qualities necessary for a book intended for both uses. He usually finds it out, however, in due season; for in future work, when the subject has become foggy in his mind, he naturally turns back to his old book to look up the points required. In other words, he naturally uses his text-books as reference books, expecting that a book with whose every page he was once familiar will be the quickest guide to some forgotten point. Too often, however, he is disappointed; the essential differences become at once clear; and as the same experience is repeated again and again, he begins to wonder if the good and brainy men who write treatises ever have to use a book of reference, that they should so generally and so utterly fail to understand the requirements of such a book.

He finds that his treatise begins with the *A B C* of the subject, and proceeds to develop it in a most methodical way. Each page grows out of the preceding page, and each chapter hangs upon the developments of the previous chapter. In his first reading, this matches his own condition of mind, his knowledge of the subject growing as the book expounds it. When he turns back to the same book for reference his needs are very different, and his point of view correspondingly different. He now wants light on some point, developed perhaps in a later chapter, and he has no idea of beginning at the beginning and following the subject up to the required point, and the time available will not allow him to do so. In too many cases, however, he finds that he is practically compelled to do it. This feature cannot be entirely eradicated from many treatises; but many books which are avowedly works of reference, show the same habit of mind in the author, and an entire failure to appreciate the requirements of a book of reference. A given subject will be treated algebraically through many pages, new symbols will be introduced from time to time as needed, and finally the subject worked down to some practical formulas. The inquirer turns to these formulas, and immediately requires the meanings of the different letters. How is he to find them? Why, by wading back through pages of text, picking up one here and another there, until he has covered them all and then made a table which he inserts in the margin, and wonders why the author could not have seen far enough into the needs of the users of his book to have followed his formula with the same table in print as a recapitulation of many pages.

Again, he finds some table of constants or data bearing on his needs, but its columns are headed with reference letters, and that same exasperating search must be made to learn what they mean.

A conspicuous sinner in this respect is Unwin's "Elements of Machine Design—" a book of the greatest value to the designer who aspires to something above rule-of-thumb methods, but as badly arranged in its make-up for a book of reference as a book well can be. We speak feelingly here, from many years' use of the book. It is distinctly intended as a book of reference, and is universally regarded as a valuable one; but its author failed to see the difference between his own habit of mind in developing his subject, and that of the user who, in his daily work, wants light on various points as quick as he can get it, and, so far as possible, with those points disentangled from their relations and associations.

The Imported Machinists.

The case of the four English machinists who came to this country recently as cabin passengers to set up some machines built in England by their employers, and who were detained as "laborers imported under contract," has been settled by the liberation of the men; permission being given them to do the work for which they came here.

This we regard as a victory for common sense and reason. We think that any builder of machinery in any part of the world should have the right to send his own machinists to set up and start his machines in any other part of the world. It has been a custom for machinery builders to do this since machinery began to be built. There is good reason for it, and we should be the first to object and to think others unreasonable who should attempt to deny American machinery builders and machinists that privilege.

Literary Note.

"Tests of Physical Properties of Cast Iron." This is a pamphlet reprinted from the "Journal of the Iron and Steel Institute," England, and contains a paper by our correspondent, Thos. D. West, of Sharpsville, Pa., on the subject named. Its interest and value to foundrymen and metallurgists is sufficiently certified to by the fact of its acceptance and publication by the association named. We believe these pamphlets can be obtained on application to Mr. West.

The Western Society of Engineers, 1737 Monadnock Block, Chicago, is inviting discussions by engineers and others on the subject of machinery forgings; such as the relative advantages of iron and steel forgings, how they may be made, finished,

etc. The society proposes to publish these discussions in the form of a pamphlet and information regarding the matter can be obtained from the secretary.

Questions and Answers.

Name and address of writer must accompany every question.

Questions must pertain to our specialties and must be of general interest.

We cannot undertake to answer questions by mail.

(62) C. H., Brooklyn, N. Y., writes: There is considerable discussion among a number of us about the question whether air in a pneumatic tire bicycle when the wheel is in motion, circulates, or is in equilibrium. Can you furnish us with the solution? A.—We do not know that this problem can be readily solved and do not think it is very important in any event, but probably there is some movement of the air within a tire when the wheel is in motion.

(63) H. A. C., Geneva, O., asks: How fast would it be safe to run, and what would be the best working speed of an upright, open front, balanced disk engine with cylinder 8 inches bore and 8 inches stroke, 120 pounds working pressure, the engine not to be overloaded? A.—For high speeds, much depends upon details of design, niceties of workmanship and perfection of lubrication, none of which particulars are within our reach. Probably 300 revolutions might be the best working speed, while it might be safe to run at double that speed.

(64) "Hi Ki," asks: In connecting several boilers to a flue leading to a chimney how is the area of flue determined? A.—If the chimney area is correct the areas of the flues may be proportioned from that. The proper starting point, however, is with the grate. Professor Thurston says: The minimum ratio of chimney flue section, section through the tubes and that over the bridge wall to grate surface should be at least, respectively, $\frac{1}{5}$, $\frac{1}{8}$, $\frac{1}{7}$. The flues, if leading from different boilers, should, of course, at any point be proportioned to the number of boilers in communication. The progressive cooling of the gases calls for a slight gradual reduction of area towards the chimney to secure a uniform rate of flow.

(65) F., Willimantic, Conn., asks: Does heading to subscribers over the column "Situations Wanted" apply to regular subscribers from the newsdealer, or only to those subscribing through your office? A.—It applies only to those subscribers who are on our subscription books in this office, and who receive the paper direct from us. 2. What would be the size of or horse-power of boiler to run a 12-horse engine? A.—It depends much upon the engine. Most engines of that size will use about 6 pounds of coal per hour per horse-power, and your boiler should be able to burn about 12 pounds of bituminous coal per hour per square foot of grate surface. This would make the grate surface 6 square feet. We cannot answer your other questions without publishing engravings which would be practically a repetition of some already published. The same principles apply to vertical as to horizontal engines.

(66) C. D., New York, writes: To settle a dispute kindly explain if a man unable to design, but experienced in making correct dimension drawings for the workshop from a designer's finished construction drawings and from finished models, besides being an expert in lettering, figuring, and the use of drawing instruments, is entitled to be called a "skilled draftsman" or if this term is only applied to designers. A.—We think the term "skilled draftsman" properly applied to, and is generally understood to mean, a man who can make first class drawings from sketches or other information given him by a designer or engineer, and that a man may properly be called a "skilled draftsman" without being able to design, though, of course, there are very few "skilled draftsmen" who are unable to do anything in the line of designing, that is, who cannot determine the proper size of a shaft or of gearing for performing certain work, etc., which, of course, strictly speaking, belongs to the designer's department of the work.

(67) C. V. A., Baltimore, asks: What will be the square feet of grate surface required, natural draft, to supply a cylinder 60 inches diameter by 11 feet stroke, 20 revolutions per minute, cut-off $\frac{5}{8}$, working pressure 35 pounds, gage, and assuming a coal consumption of 15 pounds per square foot per hour? Please work this out from the volume of steam used in the cylinder. A.—For the volume of steam used per hour, we have 5^2 feet diameter of cylinder $\times .7854 \times 22$ feet per stroke $\times \frac{5}{8}$ cut-off $\times 20$ revolutions per minute $\times 60$ minutes $= 323,977.5$ cubic feet of steam per hour. To cover all contingencies, at least 50 per cent. should be added to this, which gives us 485,966.25 cubic feet. One cubic foot of steam at 35 pounds, gage, or 50 pounds absolute pressure, weighs .1198 pound; so that our weight of water will be 485,966.25 cubic feet $\times .1198 = 58,198.75$ pounds. Assuming 1 pound of coal to evaporate 8 pounds of water, and burning 15 pounds of coal per square foot of grate, 120 pounds of water will be evaporated per hour per square foot of grate. Then, $58,198.75 \div 120 = 485$ square feet.

(68) L. A. C., Goshen, Ind., writes: Please inform me how to figure out the pitch of gear wheels, say 5 or 8 pitch. How do you get the pitch? Please give plain rules, as I am not much on mathematics? A.—We are not quite sure we understand just what you wish to know; but assuming you have gear wheels that you wish to find the pitch of, it is done by the following rule: Take the number of teeth in the gear and add 2; divide this by the outside diameter in inches, and the result is the diametral pitch. This rule expressed in a formula is

$$P = \frac{N + 2}{D}$$

where P = diametral pitch, N = number of teeth, D = outside diameter of gear. Taking, as an example, a gear wheel having 40 teeth, and which we find measures $8\frac{3}{8}$ inches or 8.4 inches outside diameter; then, substituting for the letters in the formula their values for this case, we have

$$P = \frac{40 + 2}{8.4}$$

and 42 divided by 8.4 gives 5, which is the pitch. Take another gear with the same number of teeth (40), and which we find measures $5\frac{1}{4}$ inches outside diameter; for this case the formula becomes

$$P = \frac{40 + 2}{5.25}$$

and 42 divided by 5.25 gives 8, which is the required pitch. Send to the Brown & Sharpe Mfg. Co., Providence, R. I., for their catalog, and on pages 204 and 205 you will find a number of very simple formulas for gears. A little study of these and the application of them to a few gears will make you familiar with the subject. It is very easy.

(69) J. K. T., Dayton, O., writes: I have a shaft $2\frac{7}{16}$ inches diameter running 70 revolutions per minute; I wish to make a steel sleeve to slip over this shaft and to be operated by a clutch coupling, the sleeve to transmit 8 horse-power at a point 4 inches from clutch coupling. How will I compute the thickness of this sleeve so that I will have no extra weight? A.—It will be safe to say off-hand that any weight of sleeve that will be thick enough for keying or otherwise fastening the wheel, or whatever the sleeve is to drive, will be strong enough to transmit the required horse-power. The following formula is given for the torsional strength of hollow shafts of external diameter d and internal diameter d_1,

$$Pa = .1963 \frac{d^4 - d_1^4}{d} S$$

P is the force or resistance acting to twist the shaft and a is the distance from the axis of the shaft at which the force is applied, while S is the ultimate torsional shearing resistance of the material. This formula may be applied to the case in hand. We have to assume some of the conditions of the case. Suppose the sleeve to be $\frac{3}{32}$ inch thick, or that the outside diameter is 3 inches. We may take 60,000 for the value of S, and that is quite low, as its value for steel ranges all the way from 50,000 to 150,000. A large factor of safety is to be used in this case, and it will be well to work it in here. Say that we take 5; then $60,000 \div 5 = 12,000$, and we then have:

$$.1963 \frac{3^4 - 2.4375^4}{3^4} 12,000 = 35,875$$

This will be the value of the twisting moment, Pa, which the sleeve will be amply strong to carry. Suppose that this is transmitted by a pulley or gear 4 feet in diameter, or 2 feet radius, and that the force or resistance which the sleeve is to stand is to be applied at the periphery. The work to be done, 8 horse-power on a shaft running at 70 revolutions per minute will be, at the periphery of the wheel:

$$33,000 \times 8 \div (70 \times 3.1416) = 1200$$

This is the value of P, and as the radius of the wheel is 2 feet, $Pa = 2400$, which is considerably less than the 35,875 which we found to be very liberal for the strength of the sleeve. The formula may of course be used with the external diameter of the sleeve for the unknown quantity, and it will then stand like this:

$$Pa = .1963 \frac{x^4 - d_1^4}{x} S$$

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Adding Machine. Grant; see page 27.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Engine castings $\frac{1}{8}$ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Aluminum and Brass Castings, Machinery, Name Plates. Twining Campbell, Paterson, N. J.

Marine Iron Works, Chicago, builders of steam yachts and marine machinery; catalogs free.

Mannocitin permanently prevents rust. Testimonials explain. O. Goetze, 14 Whitehall st., N. Y.

Best Presses and Dies for all sheet metal work. Ferracute Machine Company, Bridgeton, N. J.

Just issued—Catalog No. 8. Mailed Free, Clayton Air Compressor Works, 28 Cortlandt st., New York.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Key Seaters for any length of hub or width of keyway. New, handy machines. Mitts & Merrill. 913 Tilden street, Saginaw, Mich.

Duplex and special gear cutters, counterbores, cutter and surface grinders, vertical millers, hand punches and shears. R. M. Clough, Tolland, Conn.

Patent Soliciting of High Class.—D. Walter Brown, Counsel in Patent Cases, 111 Broadway, New York. Send for "Brief History of Patent Legislation."

Recent Inventions in Metal-Working Machines.

Figs. 1, 2, 3 and 4 show a side elevation, partial vertical section from the opposite side, a vertical section of the work spindle, and a feed mechanism detail of a bolt-threading and pointing machine—the invention of Mr. J. H. Haskins, of Chicago, Ill.

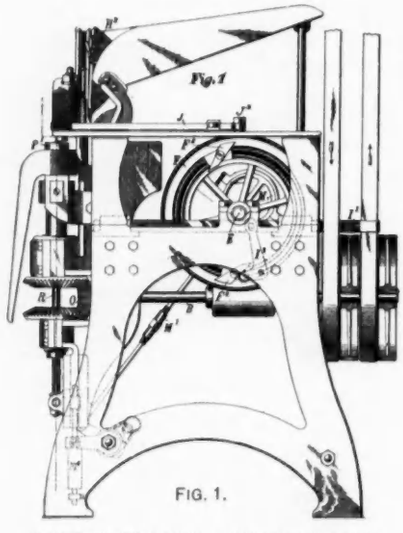


FIG. 1.

BOLT-THREADING AND POINTING MACHINE.

The machine is entirely automatic in operation, threads and points the bolts simultaneously, and is provided with safety devices at various points.

As seen in Figs. 1 and 2, shaft B is alternately driven in opposite directions by open and crossed belts. Shaft E, driven by worm f, makes at no time a complete revolution, but oscillates between limits determined by the positions of the adjustable cams F^2, which operate bell crank I^2 and belt shipper I^1. Cam wheel F carries also a peripheral cam, which operates, through stud J^2, the bolt-gripping lever J, shown in detail in Fig. 4.

Shaft E, through crank H and eccentrics G and M, operates, respectively, the hopper feed, individual blank feed and pointing device, as follows: H, by H^1, oscillates H^2 (Fig. 1) through a slot in the bottom of the hopper; G, by G^1, reciprocates feed slide G^2 in a manner clearly shown in Figs. 2 and 4 (the action of the safety device, in case of a lodged blank, being shown dotted in Fig. 2); while, by rod M^1, cam M lifts the pointing tool R. A second safety device for the pointing mechanism is shown dotted at m^4.

As will be noted, gear O drives the threading die and pointing tool in opposite directions, lessening the twist on the blank and the power required to hold it. The feeding, gripping, threading, pointing and ejecting mechanisms remain to be described.

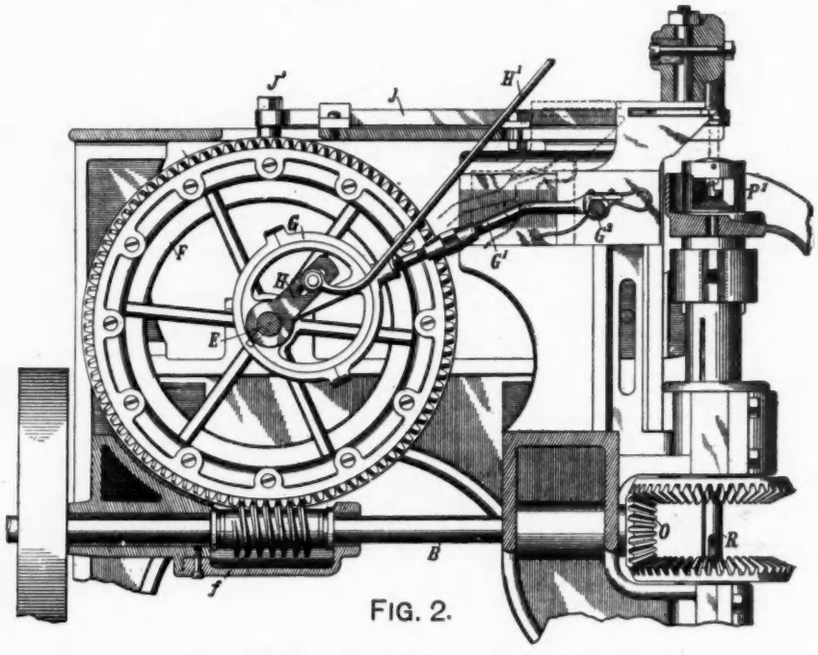


FIG. 2.

BOLT-THREADING AND POINTING MACHINE.

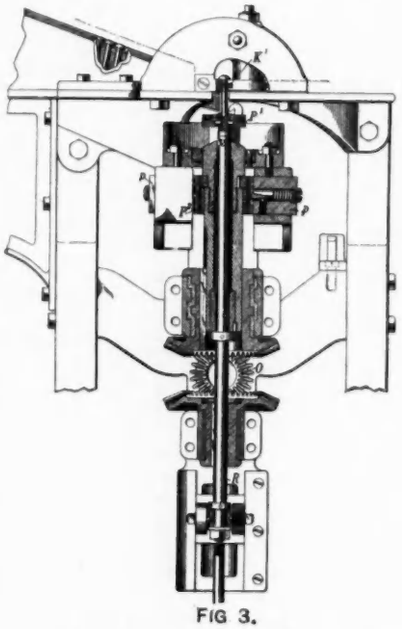


FIG 3.

BOLT-THREADING AND POINTING MACHINE.

As seen in Fig. 4, the gravity conduit makes a short turn near the gripper, at which point spring K holds the blanks till carried forward by G^2. J is eccentrically pivoted, for adjustment, at J^1, and carries a removable, hardened gripping jaw j. The advance of the next blank throws the finished one upon the beveled surface j^x whence spring k^1 ejects it.

As seen by Fig. 3, the bolt is pointed while inserted in the die, and the withdrawal of the bolt thus straightens any threads marred by the pointing. Die P^1 must, of course, be fed upward to its work; and to obviate breakage in case a blank is bent or fails to align itself with the die, feed nut P^3 is split and yieldingly held in ways p, that it may slide downward under undue strain.

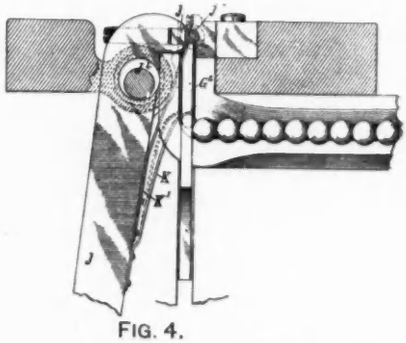


FIG. 4.

BOLT-THREADING AND POINTING MACHINE.

Chief Engineer Gilbert M. MacCarty, U. S. N., is the latest addition to the long list of naval engineers who have been made physical wrecks by over work caused by insufficient numbers in the Engineer Corps.

The Steel Question.

The question is, Who shall decide when doctors disagree; the steel maker or the purchaser? For we must admit that even the steel maker has some rights. He receives an order for steel for a certain purpose, specified, and agrees to furnish a steel which, according to his experience, will fill the requirements. The material is delivered, worked up in the tool room, then sent to the smith shop to be hardened. They are dies 8 x 10 x 5 inches. The result is a failure, which, in due time, is reported to the superintendent. A council is held of the powers that be, and very shortly a letter is received at a certain warehouse, which reads something like this: "The steel you furnished us with for those dies has proved a complete failure, and has cost us considerable. I will return the balance, but will not pay for the broken pieces, as the steel is of inferior quality and of no use to us; it cracked all to pieces in hardening and still was soft in the center of the die, which proves conclusively that it is not uniform and consequently unfit for our purpose. Yours, ——— Supt."

Steel warehouse manager to clerk: "Fred, where is George?"

"He is down at Mount Pleasant; will return to-morrow." "Then give him this letter and tell him to take the first train to Kicking Valley and make a thorough investigation of this case."

The following morning George finds himself in the superintendent's office at Kicking Valley, when something like the following conversation takes place:

"Good morning, sir," handing the superintendent his card, "I understand you have had some trouble with the steel we furnished you with for those dies?"

"I have no time to enter into scientific discussions on steel. We found it unsuitable for our purpose and I have ordered it returned; that ought to settle it."

"Would you be kind enough to show me the broken die?"

"Sir; I have fully explained the trouble to your manager, which ought to suffice." Turns round and begins to open his mail. George, about this time bites a piece of the end of his cigar and says: "If you have no objections, I would like to meet your foreman smith for a few minutes; I will not detain him long?"

Superintendent by this time begins to think George is a sticker, and the best way to get rid of him is to hand him over to the foreman smith, so he escorts him to the smith shop where the following conversation takes place: "Have you returned that steel that was no good?"

"Not yet; there was three dies made, and Bill thought he would like to try another one with salt in the water, and I told him to go ahead."

Superintendent to the foreman aside:

"This is one of those smart Alecks from town come to show us how. I will leave him with you, he will furnish you with some amusement." Introduces George to the foreman and takes his leave. The foreman takes George over to the tool fire and shows him the broken dies, and introduces him to Bill, the tool smith, who is very busy preparing his hollow fire to heat his die to receive its salt water bath. The foreman tells Bill that "this dude may stay beside him while he hardens the die, but you go right ahead and take no notice of him."

The fire now ready, he puts in his die face up, closes up the front of his fire, pulls on the blast strong. George suggests: "Don't you think it would be better to shut your blast nearly off in order to give your die time to heat uniformly?"

But Bill cut this suggestion short by a look which indicated something was going to heat before the die. After some time he takes his poker and pokes a hole in front and fills the bottom up with coke, puts a piece of coke over the hole, pulls on the blast and says "She's doing nicely," then goes to the hydrant to take a drink. At this time George accidentally happens to touch the blast handle and when Bill returns he discovers something has happened, and inquires of the helper about who has been monkeying with the blast. The helper saw nothing, but the ever watchful hammer boy thought he saw the stranger give it a kick. Bill is now hot and it looks as if something would crack before the die. But the die is now hot and ready for the bath. The bottom of it is a light orange color, the top around the edges is a bright red, but the center is of a much darker hue. "Here she goes." George interposes, but being a much smaller man than Bill, shut up with the remark, "She's gone." Into the bath she goes, Bill swings it around vigorously a few times then drops it to the bottom, where he lets it lie for a short time. The helper then picks it up with his tongs and Bill puts his hands under the water to feel if it is cold for he does not want to remove it until it is perfectly cold; he knows the danger, but it feels cold, so he lifts it out.

"Why, I declare, it is not cracked;" a miracle, to George, at least; lays it on the bench; all look at it. "If it has hardened in the center it is all right; get a fine file quick; a little soft in the center" click, "what was that?" click, "she's gone."

The superintendent arrives about this time and addresses George in the following terms: "Now, young man, what do you think of your steel. I am sure you must be satisfied it is no good; might do for pinch-bars; better leave it here and save freight charges?"

George replied: "You have made me a proposition, allow me to make you one. You have one more die, I understand, ready to harden. Allow me the privilege of hardening it."

"Ridiculous; don't you think we have fooled away too much time and money now? We cannot afford to give our works over to your company for experimental purposes on their worthless goods."

" I want to harden that die and will pay you for the use of the fire and blacksmith and helper's time."

After a short consultation with the foreman the superintendent says, "That's a go."

George now removes his coat, but as Bill has mislaid the key of his cupboard, he hangs it on the wall beside the window and puts his collar and cuffs on the sill with his hat on the anvil. The hammer boy becomes interested in this performance and accidently sits down on his hat, but fortunately it is his soft one, he having left his high one with his uncle for the St. Patrick's procession. The helper now having occasion to raise the window, accidently knocks the cuffs off the sill into the slack-tub.

While these trifling incidents are taking place our friend has got his fire in order, places his die in the fire, face side down, closed up the front and opened the blast a very little. He then empties the hot water from the tub, places two pieces of iron in the bottom to lay his die across, fills the tub with cold water, and, after some trouble, secures a piece of hose which he attaches to the most convenient tap and tries it, finding the pressure is strong, the only thing he has so far found strong in his favor. He now examines his die, it is a dark red; fills up the bottom of his fire, and uses the blast very sparingly, watching the face until it comes up to a heat in the center as hot as the edges, a bright cherry red; the back is darker as it does not require to be hard; the desired heat is obtained; no hot corners, no cold center. All being ready he removes it from the fire and lays it across the two pieces in the tub, starts his hose, holds it as near the center of the die as possible, has the helper keep the water in motion with a stick and says, "Boss, I am done with your fire; much obliged to you;" leaves orders for no one to touch it and takes a walk around the shop.

He now feels like making some complimentary remarks to the foreman on the condition of his shop, but he finds him not quite ready to talk. He now lifts the die from the tub, places it in another where the water is cold, and leaves it there.

What is Bill doing all this time? He is simply waiting to have the laugh on smart Aleck, who will have to pay for his time anyway. Our friend is now washing up, adjusting his collar and cuffs, which are now not so clean as when he arrived.

He now takes the die from the tub and lays it on the bench. The file is applied, the file will not touch it even in the center. Bill suggests "the file is played out." The helper is dispatched to the tool room for a new three square file.

The superintendent arrives and calls

for a file, is told the one here is "no good; gone for a new one."

"Let me see it;" tries it on the die, said something that sounded like O. K.., he then left requesting George to call in the office, which he did. Needless to say good cigars were in order with a letter to the manager of the steel house. The foreman and he parted best of friends, and even Bill shook hands with him.

L. G.

Studebaker Bros., of South Bend, Ind., who are among the largest, if not the largest vehicle builders in the world, are sending out a large chromo reproduction of an oil painting showing the original blacksmith shop in which the present business was started. The picture is a fine one and will be appreciated by those fortunate enough to receive one.

The date of the St. Louis meeting of the American Society of Mechanical Engineers is now officially announced as May 19th to 22d.

COMMERCIAL REVIEW.

NEW YORK, SATURDAY EVENING, MARCH 21.

Mill and Machinists' Supplies.

Spring trade in these lines has not yet opened up. The market is not without its representatives who report more or less improvement in demand; but others feel as though every day were like a holiday, and the greatest consensus of opinion and experience seems to be with the latter class. Unfavorable weather doubtless has something to do with it. Why a factory owner should wait until two or three pleasant days come in succession before laying in supplies for his shop may not be altogether obvious, but there appears to be truth in it. With the first of April, Easter, and a taste of mild, bright weather, we hope for better things.

The present unsatisfactory view is founded upon the experience of New York City sellers of miscellaneous supplies, both the smaller and the larger classes of goods. Some especial lines may be considered individually.

For twist drills there is ever a good and fairly steady demand. They are a staple and a necessity, rather than a luxury. The present is said to be a busy season of the year from the standpoint of the manufacturer. The trouble with drills is low prices. Files, though selling in some quarters, suffer from small figures. We are told that one prominent company are disposing of all they can make. There is a rumor that the cotter makers have formed a combination and at the first of April will advance prices, but it lacks corroboration.

In machine screws, prices have continued weak. An advance is suggested as likely to take place, but we are inclined to doubt it. The Hartford Machine Screw Co. write, under date of the 17th inst., that they "have detected no particular improvement so far this month, over last month or a year ago. Prices have not changed materially. So far as screws, nuts and work of this class enter into the construction of bicycles, there is an active demand, but in all other lines trade is quiet." The Illinois Screw Co. say: "Since the middle of last month, there has been no change in price and with us none in the volume of trade. This month, so far, is more than double the first half of last March. We see no reason for a decline in prices."

In power transmitting machinery, such as hangers, pulleys and the like, there are prevalent very low figures and the volume of trade, even at the prices obtainable, is not anything to boast of. The following are miscellaneous opinions of sellers: "Our trade is fair and about the same as it has been." "Quieter than thirty days ago. Factories are more anxious to sell than sixty days ago, and prices have suffered. Wood pulleys hold on best." "Wood pulleys have been duller for the last five or six days. Weather may exert some influence, and the state of the tariff does also, for in the New England district the woolen and iron concerns are purchasing supplies, while the cotton and rubber seem not to be in a condition to buy." "Some improvement." "We have been busy right along and have about enough to keep us going through the spring, but prices are demoralized." Another concern handling a general line of mill supplies including power transmitting machinery, forges, etc., reports dulness since the first of the year.

The trade in blowers and fans suffers in common with other classes of goods. Some of the figures made are very unprofitable. One company with which we have corresponded and whose opinion should be rather authoritative seems to take an unfavorable view. The trade in ventilating fans for city use has not yet opened up for the summer season. A local concern tells us that its out of town trade is governed, as to season, by conditions different from those which affect ventilators for city buildings and has been relatively active during the winter.

The Buffalo Forge Co., manufacturers of blowers, forges, engines, etc., are pleased with the results of their business. This they ascribe to hustling and to quality, on their part, which may account for the very favorable nature of their experience. They say: "Our sales for the past month, and in fact since January 1st, have been much larger than we had expected in our most sanguine moments. In fact, the increase as compared with the corresponding period of last year, is fully equal to that shown by the latter as compared with the corresponding period of the preceding year. As far as prices are concerned, we have made no change and anticipate making none."

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Brass molder, 25 years' experience, could take charge. References. Box 72, AM. MACHINIST.

Sit. wanted, hyd. and spec. mch. designer; tech. educa.; can take charge room. Box 12, AM. MACH.

Wanted—First-class tool hand. State age, experience and wages expected. A. M. G., care AM. MACH.

Wanted—Position as foreman by a thoroughly up-to-date pattern maker. 14 years' experience; age, 40 years. Box 64, AMERICAN MACHINIST.

Wanted—A position as foreman or asst. supt. of machine shop by young man of 32 years; am fair draftsman. Experienced, Box 71, AM. MACHINIST.

Wanted—Position as supt. or foreman by person experienced in designing and bldg. tool machinery, manfg. hardware and wire goods. B. W., AM. MACH.

A first-class pattern maker who has also fair ability as draftsman and designer. Address, West Penn. AM. MACH., giving age, references, wages expected.

Competent mechanical draftsman wants position. 12 years' experience in steam, hydraulic, pneumatic machinery. Will go anywhere. Box 75, AM. MACH.

Wanted—Position as brass f'ndry foreman, thoroughly exp'd in steam fitters' and plumbers' supl's; also mixing of metals. Ad. Steam, care AM. MACH.

Wanted—An established Eastern Canadian company with entirely new bldgs. wants for'mn for its fn'dy. Does med. and hvy. wk. on min'g and mill'g machy., engines, etc. J. M., AM. MACHINIST.

Mech. draftsman and designer, wants position; 12 years' experience on automatic engines, jigs, pumping and special mach. Comp'tent in charge of work. Eastern States pref. Box 68, AM. MACHINIST.

Agents wanted to sell the Gem Hat Holder, especially adapted for use in church pews. There is a large field for this article. Will sell the patents, and can send samples. Address John R. Hirsh, 713 Otisco Street, Syracuse, N. Y.

Situation wanted by a young man well up in the manufacture of hardware specialties; first-class tool and die maker; have experience in electrical and bicycle work; last five years as superintendent. P. D., AMERICAN MACHINIST.

Wanted—A practical machinist with a few thousand dollars, also a business experience, to take an interest in a long established and good paying business. A good opening for the right man. Address S. M. Co., Box 805, Bridgeport, Conn.

Wanted—A foreman for tool department; one who is used to punches, dies, jig and fixture work, and is able to do designing for all kinds of tool work. Apply, stating experience and wages expected, to P. O. Box 491, Toronto, Can.

Wanted—By an up-to-date foreman who understands his business and attends to it, position as general foreman or assistant superintendent for wide-awake manufacturer who appreciates ability and energy. Address Box 73, AM. MACHINIST.

Mechanical engr. and draftsman, capable and exp. designer, competent to take charge, desires responsible pos.; exp. on engines, hoisting and conveying machinery, tools and labor-saving devices and general machy.; A 1 refs. Ad. B. L., AM. MACH.

Tool makers wanted, or machinists used to the finest and most accurate class of work. Those experienced in the building and operating of fine automatic machinery preferred; must be quick and intelligent. Good wages and permanent position to the proper man. Box 74, AMERICAN MACHINIST.

Wanted—First-class tool maker and up-to-date all-round machinist; must be a good draftsman, familiar with modern machine shop practice, and capable when necessary of taking full charge. Promotion to foreman open to the right man. Foster Engineering Co., Newark, N. J.

Wanted—First-class general foreman by concern building high grade mach. tools. One with experience in this line preferred. Must be thoroughly acquainted with modern methods and capable of handling men to the best advantage. Steady position for right man. Address, stating age, experience and salary expected, A. M. G., care AM. MACHINIST.

MISCELLANEOUS WANTS.

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York,Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Best and cheapest Bolt Header made by C. H. Baush & Sons, Holyoke, Mass.

For Sale—A first-class key-seater, new. Address Mitts & Merrill, 913 Tilden st., Saginaw, Mich.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Wanted—To trade for or buy a 22 or 24 second-hand engine lathe, modern. R. Kinghan, Winfield, Kan.

For Sale—Two Warner & Swasey speed lathes, in first-class condition. Penberthy Injector Co., Detroit, Mich.

6-inch, 8-inch and 10-inch screw cutting lathes, milling and gear cutting attachments. Wallace H. Mansfield, New Haven, Conn.

For Sale—One American Watch Tool Co.'s lathe No 3 with attachments; also 17 in. by 6 ft. and 10 ft. lathe, planer, drill press, foundry outfit, etc. S. Heberling, Des Moines, Ia.

Just Published. Two Reliable Books.

"SHOP KINKS,"

By ROBERT GRIMSHAW. Showing special Ways of Doing Work Better, more Cheaply, or more Rapidly than Usual.

400 Pages, 225 Illustrations, $2.50.

"THE MODERN MACHINIST,"

By JOHN T. USHER, Machinist,

320 Pages, 257 Illustrations, $2.50.

Illustrated circulars of both sent free.

Our Catalogues of Books for Machinists, Engineers, Electricians, etc., also sent free.

NORMAN W. HENLEY & CO., Publishers,
15 Beekman Street, NEW YORK.

MACHINERY
For Reducing and Pointing Wire.

ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.

For Machines or Information address the Manufacturer,

S. W. GOODYEAR, Waterbury, Conn.

CORRECT PROPORTIONS PRYBIL HANGERS GET A BOOKLET.

JUST READY. Oblong, 8 x 11 in., boards, 23 pp. text, 44 illustrations, and 9 full-page plates,

PRICE, $1.00.

Lettering for Draftsmen, Engineers & Students

A Practical System of Freehand Lettering for Working Drawings,

By CHARLES W. REINHARDT,
Chief Draftsman for "Engineering News."

D. VAN NOSTRAND COMPANY,
IMPORTERS and PUBLISHERS of SCIENTIFIC BOOKS,
23 Murray and 27 Warren Street, NEW YORK.
Copies sent by mail on receipt of price.

WE WANT

Some live men to take State Agencies for the

American Machinist

Subscription Department. A good thing, and a permanent place for the right kind of man. Address,

American Machinist
Publishing Company,
256 Broadway, N. Y.

COMBINED DRILL AND COUNTERSINK
FOR CENTERING LATHE WORK.

J. T. SLOCOMB & CO.,
PROVIDENCE, R.I. U.S.A.

MILLING CUTTERS
IN VARIETY
MANUFACTURED BY
J. ERLANDSEN
172 CENTRE ST. NEW YORK.
SEND FOR CATALOGUE
WARRANTED

Power Hammer
THE BEAUDY CHAMPION
UP TO DATE
BEAUDY & CO. 45A Oliver St. Boston

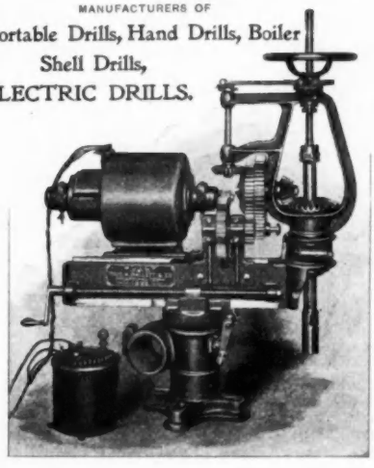
THE WIRT DYNAMO BRUSH.
Send for Pamphlet. **CHARLES WIRT,** 1028 Filbert Street, PHILADELPHIA.

Upright Drills
and General Line of Machine Shop Tools.
HILL, CLARKE & CO.
160 Oliver Street, BOSTON.
16 S. Canal St., Chicago.

WANTED.—An experienced man for superintendent of a large bicycle factory. Must be thoroughly conversant with all mechanical details connected with the position, possess good executive ability and be a proficient cycle engineer. Only a high-grade man with these qualifications need apply. Applications will be considered strictly confidential. State experience. Address WILLIAM P. SCOTT, 309 Broadway, New York City.

BICYCLE PUMPS,
VISES,
JACK SCREWS,
BENCH SCREWS.
Send for Catalogue "B."
CAPITAL MACHINE TOOL CO., Auburn, N.Y.

THOS. H. DALLETT & CO.
PHILADELPHIA.
MANUFACTURERS OF
Portable Drills, Hand Drills, Boiler Shell Drills,
ELECTRIC DRILLS.



Leather belting has not been very active during the winter, nor is any material alteration of circumstances reported at the present time. Prices are steady and no change seems imminent. They are however, dependent upon hides, which are a variable quantity, and appear now to be tending downward rather than upward. There has been some demand for belting from cotton mills. As to the present prices of belting, one seller tells us that there is little or no profit as compared with the cost of hides six months ago, which is about the difference in time between the crude material and the finished product.

Supplementary to the account of the refrigerating machinery business given last week, we print the following from the Newburgh Ice Machine and Engine Co.: "The prospects are fairly favorable, prices are low and have a tendency to remain so. We have been successful in securing all the work required to keep our shop going to its full capacity, and feel encouraged to think there will be a gradual improvement in business." Another seller tells us that the trade of the past season has been below the average. There has been quite a good deal of inquiry, but much cutting of prices. Of the two, cold storage machinery has been more active than that for ice making. He believes his own concern is not alone in this experience.

Iron and Other Metals.

The iron and steel market remains very dull indeed, with prices correspondingly weak. A leading firm handling Southern irons state that their business for the month will foot up unusually high, but even they do not think the present situation is generally bright.

Before going to press, on Monday, we learn that the price of standard Bessemer ore has been fixed at $4.00 per ton.

The metals have been generally quiet, lead being in fair selling.

QUOTATIONS.

NEW YORK, Monday, March 23d.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 75 @ $13 25
No. 2 foundry, Northern	11 75 @ 12 50
No. 2 plain, Northern	11 25 @ 11 75
Gray Forge	11 00 @ 11 75
No. 1 foundry, Southern	12 25 @ 12 75
No. 2 foundry, Southern	11 25 @ 11 50
No. 3 foundry, Southern	11 00 @ 11 25
No. 1 soft, Southern	11 25 @ 11 75
No. 2 soft, Southern	10 75 @ 11 25
Foundry forge, Southern	10 50 @ 10 75

Bar Iron—Base, in Carloads—Mill price, on dock: common, 1.20 @ 1.30c.; refined, 1.30 @ 1.50c. Store prices, f. o. b.: common, 1.40 @ 1.50c.; refined, 1.50 @ 1.70c. Quotations on dock 10 per cent. lower than those given have been published, but some prominent sellers deny that they represent the rates for ordinary business.

Tool Steel—Ordinary sizes, standard quality, 5¾ @ 7c.; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—In carloads 1.45 @ 1.55c., mill price; from store, 1.75c. Special brands upward.

Cold Rolled Steel Shafting—Base, 2½c. in carloads; 2¾c. for smaller quantities from store.

Copper—Carload lots, Lake Superior ingot, 11c.; electrolytic, 10¾ @ 10⅞c.; casting copper, 10½ @ 10⅝c.

Pig Tin—For round lots, 13.35 @ 13.40c. f. o. b.

Pig Lead—In carloads, about 3.15c. f. o. b.

Spelter—In carload lots, New York delivery, 3.15 @ 3.20c., perhaps @ 3.25c. for special brands.

Antimony—From store, in wholesale lots, Cookson's, 7¾@8c.; Hallett's, 6⅞c.; Japanese, 6¾c.

Lard Oil—Prime city, present make, 51 @ 52c., in carload lots.

NEW CATALOGS.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one or the other standard sizes should be adopted if possible.

Massachusetts Institute of Technology sends us catalog 1895-6, in which the work being done at this well-known institution is fully set forth. The catalog contains 290 pages and is 5¾ x 8⅞ inches—probably intended to be standard size.

Thomas Devlin & Co., Philadelphia, Pa., send us a catalog of malleable iron and other fittings designed for piping, the catalog showing a very large variety of such articles, some of which are of new forms. The catalog is 7⅝ x 11 inches.

The Backus Water Motor Co., Newark, N. J., send us a fine catalog, illustrating and describing the Backus Electric Ceiling Fans, which are used in offices and other places where it is desirable to secure a circulation of air in warm weather. The catalog is quite an artistic one, and is 6x9¼ inches.

The Cincinnati Milling Machine Co., Cincinnati, O., send us a pamphlet illustrating and describing their latest forms of universal and plain milling machines. The pamphlet also contains a large number of very complimentary letters received from users of these machines, and a formidable list of shops in which they are used. The catalog is an elegant production, and is standard size, 6 x 9 inches.

Messrs. S. S. Hepworth & Co., 15 Cortlandt st., New York, have issued a catalog for 1896, printed in the Spanish language. The catalog contains a number of wood cuts, illustrating various kinds of machinery made by them, used in the manufacture of sugar. These cuts are accompanied with full descriptions. Among the machines illustrated and described are elevators, grinders, mixers, etc. The catalog is standard size, 6 x 9 inches.

H. W. Johns Mfg. Co., 87 Maiden Lane, New York, have issued a pamphlet in which there are illustrations of the locomotive exhibits at the Atlanta Exposition. The idea of the pamphlet is to set forth the merits of the H. W. Johns' Asbestos Cement Felting; but incidently the opportunity is taken to give a number of very good illustrations of the latest locomotives, and the pamphlet is an interesting one. It is sent to those interested on application, and is 4½ x 8 inches.

The Lodge & Shipley Machine Tool Co., Cincinnati, O., have issued a catalog in which they illustrate and describe their latest productions in machine tools, which include improved engine lathes, turret-head screw machines, etc., among the latter being one that is particularly adapted to making bicycle-wheel hubs. Special machines for boring and turning pulleys are also illustrated and described. The catalog is sent to those interested on application, and is 7¾ x 10¾ inches.

We have received a copy of a pamphlet entitled, "The Separation of Grease from Exhaust Steam," by Mr. Wm. J. Baldwin, the well-known heating engineer and expert of this city. The pamphlet describes and gives accounts of the injury to boilers due to the return of condensed exhaust steam from heating coils without separation of the oil from the engine cylinder. Following this is an illustrated description of Mr. Baldwin's grease extractor, with a table of sizes and prices. The pamphlet is not standard size, and while a superior specimen of typography, would have been better, we think, had it not been stitched with a cord, so applied as to prevent the pamphlet being kept open without a paper weight.

MANUFACTURES.

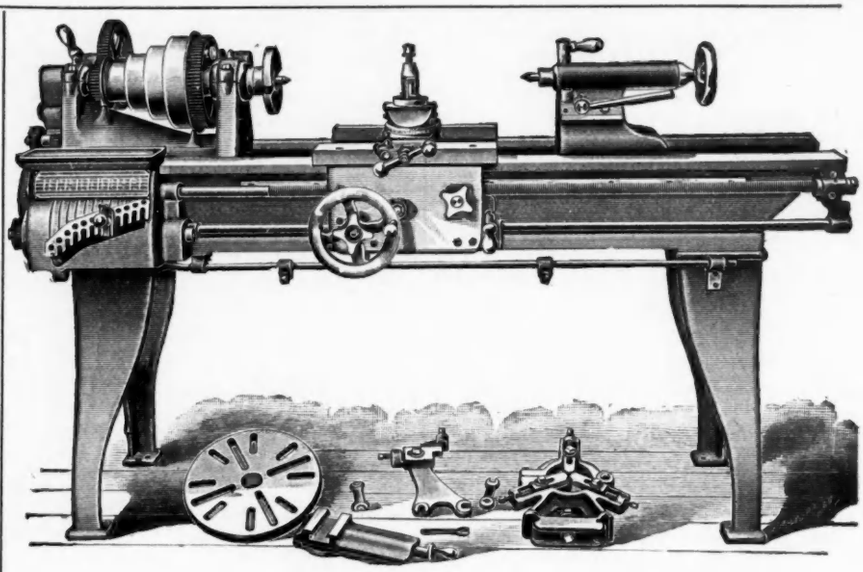
The canning factory of C. H. Treat at George town, Del., has been purchased by a stock company and will be rebuilt for a bicycle factory.

At Fairfield, Me., the Maine Electrical Construction Co. have commenced a foundry and machine business. Mr. A. B. Smith is President, and H. M. Mansfield is Treasurer.

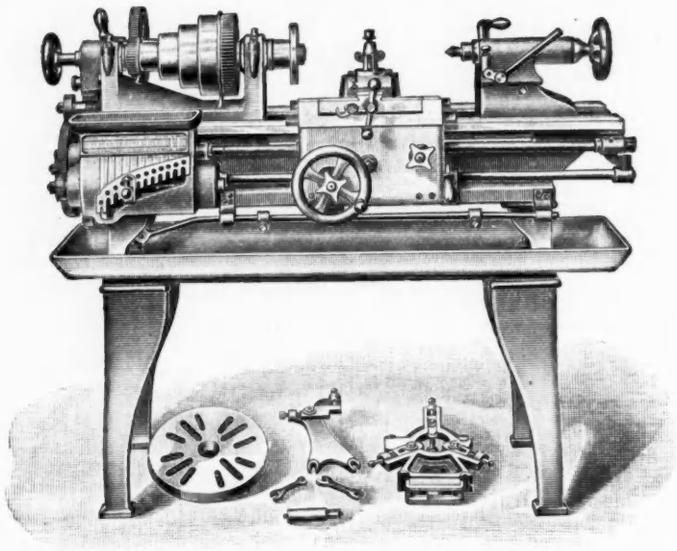
East Taunton, Mass., is to have three new yarn mills. These are to be built at once for the Corr Mfg. Co. Each of the mills is to have a capacity of 40,000 spindles. Colonel P. H. Corr is to be president.

The Pearson & Phelps Co., builders of machine tools, formerly of 20 North Desplaines street, Chicago, announce a change of name to The Pearson Machine Co., and a change of location to 31-45 West Randolph street, Chicago.

T. W. English and others of Galveston, Tex., have formed the Kirkpatrick Manufacturing Co. for the purpose of making a new style of water gas machine: capital stock is $50 000.



14-in. x 6 ft. Hendey-Norton Lathe, and 12-in. x 4 ft. Hendey-Norton Lathe. These are modern, high-grade, practical tools, and are specially adapted for tool-room work. They have the Norton Attachment for screw cutting, giving 36 different threads and 36 different feeds with only two changes of gear, and movement of lever in gear box from one notch to the other. Note the automatic stop under apron. It will automatically stop carriage at any desired point in either direction. Invaluable for internal or duplicate work.



The 12-in. Lathe is fitted with drawing-in sleeve and American Watch Tool Co.'s Standard Chuck, used in making small taps, reamers, etc. Work finished first and cut from bar afterward. No centering required. See carriage reverse lever by right-hand side of apron; no reaching for countershaft shipper required.

SEND FOR CATALOGUE.

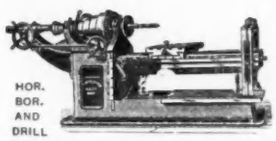
The Hendey Machine Co.,
TORRINGTON, CONN.

European Agents:
CHAS. CHURCHILL & CO., London, Eng.
SCHUCHARDT & SCHUTTE, Berlin, Germany.
EUGEN SOLLER, Basel, Switzerland.

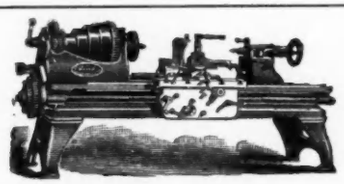
PRATT & WHITNEY CO.,
Hartford, Conn., U. S. A.,
MAKERS OF
FINE MACHINE TOOLS.
Complete Plants Furnished for **BICYCLE, TYPE-WRITER, GUN** and **SEWING MACHINE MAKERS.**
GAUGES AND SMALL TOOLS FOR GENERAL MACHINE WORK.
DROP HAMMERS and TRIMMING PRESSES.
FORGING AND TRIMMING DIES FOR ALL CLASSES OF WORK.
England—BUCK & HICKMAN, 280 Whitechapel Road, London, E.
England—CHAS. CHURCHILL & CO., Ltd., 21 Cross St., Finsbury, London, E.C.
France—FENWICK FRERES & CO., 21 Rue Martel, Paris.
France—F. G. KREUTZBERGER, 140 Rue de Neuilly Puteaux (Seine).
CHICAGO—42 and 44 South Clinton, cor. Washington Street.
BOSTON—47 Pearl Street.
NEW YORK—138 Liberty Street.

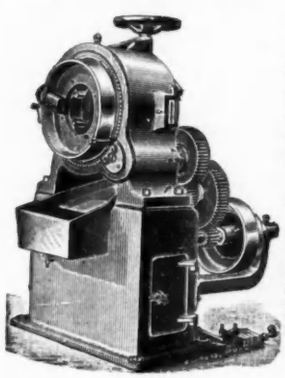
FINE TAPS AND ADJUSTABLE TAP WRENCHES.
SEND FOR CATALOGUE.

Wiley & Russell Mfg. Co.
Greenfield, Mass., U. S. A.

SPECIAL MACHINERY DESIGNED AND BUILT TO ORDER.

HOR. BOR. AND DRILL MACH.
For Particulars Address
FITCHBURG MACHINE WORKS,
FITCHBURG, MASS., U. S. A.
Manufacturers High-Grade Machine Tools.
Catalogue E, and List Good Second-Hand Tools.

BY SIMPSON BOLLAND.
The Iron Founder, - - - - - $2.50
The Iron Founder Supplement, - - - - 2.50
Encyclopedia of Founding. Each 12mo. Cloth.
JOHN WILEY & SONS, New York.


NEW HAVEN MANFG. CO.
NEW HAVEN, CONN.
IRON-WORKING MACHINERY,
Planers, Shapers, Drills, Slotters, Etc.


CURTIS & CURTIS,
66 GARDEN ST., BRIDGEPORT, CONN.
Pipe Cutting and Threading Machinery,
FOR HAND OR POWER.
RATCHET DRILLS, RATCHET DIE STOCKS AND MALLEABLE IRON PIPE VISES.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD, CONN.
J. M. ALLEN, PRESIDENT.
WM. B. FRANKLIN, VICE-PRESIDENT
F. B. ALLEN, SECOND VICE-PRESIDENT
I. B. PIERCE, SECRETARY & TREASURER

RUST PERMANENTLY PREVENTED BY USING MANNOCITIN
ASK FOR PROOFS
O. GOETZE SOLE AGT. 4 WHITEHALL ST., NEW YORK.

A calculating machine will improve the accuracy of any arithmetical work, and also enable the book-keeper, accountant, civil or mechanical engineer, or man of science, to avoid much labor and save some time. There is no room here for a description, but we should like to send you our interesting pamphlet. Grant Cal Mch Co. Lexington, Mass.

The McDaniel & Merrihew Cycle Mfg. Co., of Wilmington, Del., which was started last September, are so rushed with orders that they will be obliged to build an addition to their present buildings at once and add to their stock of tools.

Clark & Cole, box manufacturers, Middleboro, Mass., are contemplating the purchase of an outfit for the manufacture of the "dovetail joint" packing box for the shoe trade, and will also increase their engine capacity from 60 to 100 horse-power.

The Carterville Foundry & Machine Co., of Carterville, Mo., whose shops were recently destroyed by fire, will rebuild at once, and have placed orders with the Davis & Egan Machine Tool Co., of Cincinnati, O., for their new equipment of machinery.

The Mason Machine Co., of Taunton, Mass., will build additions to their foundry this spring, making room for thirty more molders. This company will put in all the cards, drawing frames, railway heads, etc., for the Corr Mfg. Co.'s new mills at East Taunton.

Caskey Bros., the recent purchasers of the Newport News (Va.) brass and iron foundry, will make extensive improvements to same, including the erection of a cupola, elevator for hoisting pig iron to cupola platform, 21 new brass furnaces, 50 horse-power engine and 100 horse-power boiler.

Sealed proposals are being invited until April 20th, for furnishing and putting in place a new boiler, and repair work on Light House Tender Arbutus. Intending bidders can obtain specifications and other information by addressing Major J. B. Quinn, Engineer 7th and 8th Light House Districts, New Orleans, La.

At Pittsburgh, Pa., a new steel car truck manufactory is to be commenced. About four acres of ground on the Allegheny river has been purchased for the site. The capital is $300,000, and the new industry is expected to give work to about 600 men. Newton A. Hemphill, of McIntosh & Hemphill, is interested and will be manager.

At Syracuse, N.Y., it is learned that a large plant is to be erected for the manufacture of saleratus. The works will be built at once, and will consist of a large three-story brick building about 150 x 100 feet. John E. Dwight, of New York City, who represents a large capital in saleratus and baking powder, is interested in the movement, as is also the Solvay Process Co., of Syracuse, N. Y.

Bids are being invited by office of Lighthouse Engineer, Ninth and Eleventh districts, until April 15th, for furnishing the boilers, machinery, etc., for twelve complete steam fog signals, in sets of two, and for six boilers with fittings, delivered at the Lighthouse Depot, Detroit, Mich. Prospective bidders may obtain additional particulars by addressing a line to Major M. B. Adams, U. S. A., Lighthouse Engineer, Detroit, Mich.

Sealed proposals are being invited until April 15th, for furnishing the boilers, machinery, etc., for twelve complete steam fog signals, in sets of two, and for six boilers with fittings, delivered at the Lighthouse Depot at Detroit, Mich. Prospective bidders desiring plans, specifications and blank forms of proposals can obtain same by addressing Major M. B. Adams, Lighthouse Engineer, 9th District, Detroit, Mich.

The Davis & Egan Machine Tool Co., of Cincinnati, O., inform us that they have just received from their agent in Brazil one of the largest orders ever received from South America. This order consists of a number of their largest tools and amounts to over ten thousand dollars. One of the machines alone will require two freight cars to transport it from their works to New York, from which point the shipment will be forwarded to Brazil.

The Grinding Machine made by the Appleton Manufacturing Co., Twenty-ninth and Thompson streets, Philadelphia, and described and illustrated in our issue of October 10, 1895, has since been improved, and is now made in greater variety than formerly. Circular work is ground upon this machine in a great variety of forms. The rotation of the work is accomplished by its contact with the grinding wheel, while it is at the same time controlled by a suitable brake.

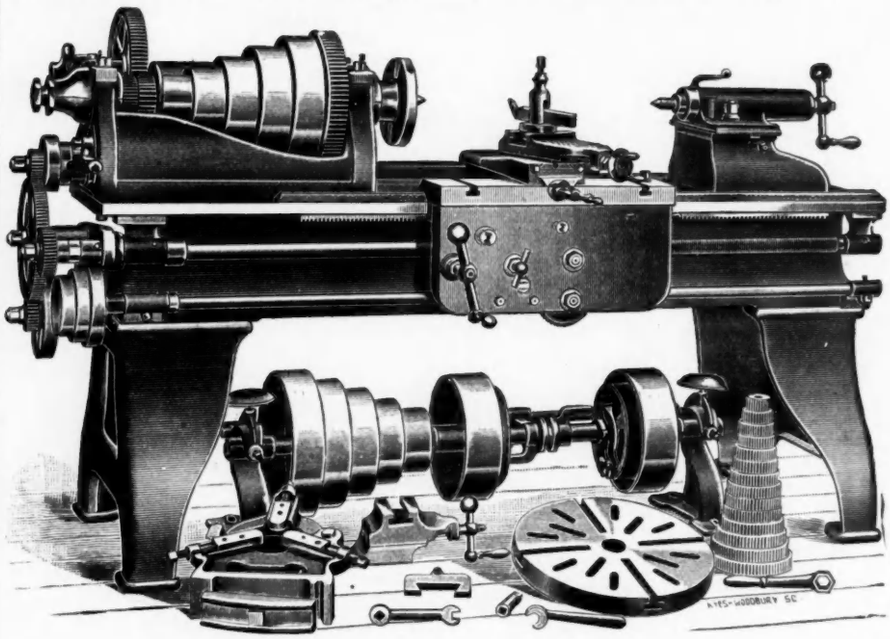
The New York Central Iron Works Co., Geneva, N. Y., manufacturers of the Dunning boiler, have appointed Mr. Charles F. McGill secretary and manager of the company, in place of Mr. Charles H. Hake, who has lately resigned. Mr. McGill has long been connected with the works as superintendent, having charge of all construction work, and is familiar with the business in every detail. The works have recently been enlarged and increased facilities have been added.

The A. L. Brooks Co., of N. Chelmsford, Mass., are to erect a saw and planing mill at that place at once. Plans are drawn for a mill 40 by 180 feet, 2 stories high, of wood. They will turn out all kinds of building material. The machinery will consist of Harris-Corliss Engine of about 150 H. P., two 6-foot tubular boilers 16 feet long, besides being fully equipped with latest improved band and circular saws, planes, etc. They will have an automatic chute for carrying the sawdust from the mill to the boiler room, and also to the railroad cars outside the mill.

INDEX TO ADVERTISERS.

	PAGE
Abbott, Wheelock & Co.	36
Acme Machinery Co.	Cover
Adams Co., The	36
Albro-Clem Elevator Co.	38
Almond, T. R.	32 and 37
Alteneder & Sons, T.	37
American Gas Furnace Co.	30
Ames Iron Works	40
Armstrong Bros. Tool Co.	39
Armstrong Mfg. Co., The	34
Aurora Tool Works	40
Backus Water Motor Co	40
Bacon, L. Seward	Cover
Baird & Co., Henry Carey	36
Baker Bros.	Cover
Barker & Co., William	37
Barnes Co., W. F. & John	33
Baush & Sons, C. H.	Cover
Beaudry & Co.	25
Besly & Co., Chas. H	35
Betts Machine Co.	28
Bickford Drill and Tool Co.	34
Bilgram, Hugo	40
Billings & Spencer Co., The	Cover
Blaisdell & Co., P.	32
Bliss Co., E. W.	30
Boston Gear Works	38
Brainard Milling Machine Co.	37
Brown & Sharpe Mfg. Co.	Cover
Buffalo Forge Co.	Cover
Builders Iron Foundry	31
Bullard Machine Tool Co.	34
Burr & Houston Co.	36
Capital Machine Tool Co.	25
Cincinnati Milling Machine Co.	Cover
Cleveland Machine Screw Co	38
Cleveland Twist Drill Co.	31
Coffin & Leighton	30
Comstock, Wm. T.	34
Cooke & Co.	29
Correspondence School of Technology	36
Conover Mfg. Co.	36
Cox Computer Co.	34
Crescent Steel Co.	36
Curtis & Curtis	27
Cushman Chuck Co.	35
Dallett & Co., Thos. H.	25
Davis, W. P	Cover
Davis & Egan Mach. Tool Co	39
Dawson & Goodwin	38
Deane Steam Pump Co.	Cover
Detrick & Harvey Machine Co.	33
Diamond Machine Co.	35
Dietz, Schumacher & Co.	35
Dixon Crucible Co., Joseph	39
Draper Machine Tool Co.	39
Durant, W. N.	33
Dwight Slate Machine Co.	29
Elliott Chemical Works	30
Erlandsen, J	25
Evans Friction Cone Co	38
Fay & Co., J. A.	32
Felt & Tarrant Mfg. Co	38
Ferracute Machine Co.	33
Fifield Tool Co.	Cover
Fitchburg Machine Works	27
Flather & Co.	37
Forbes & Co., W. D.	36
Fox Machine Co.	36
Frick Co., The	40
Garvin Machine Co., The	29 and Cover
Goetze, O	27
Goodyear, S. W.	25
Gould & Eberhardt	35
Grant Calculating Machine Co.	27
Gray Co., G. A.	Cover
Harrington, Son & Co., E.	35
Hartford Steam Boiler Insp. and Ins. Co.	27
Hayden & Derby Mfg. Co., The	Cover
Hendey Machine Co	26 and Cover
Henley & Co., N. W.	25
Hill, Clarke & Co.	25
Hobart, F. G.	37
Hoggson & Pettis Mfg. Co.	35
Home Study	39
Horton & Son Co., E.	35
Hurlbut-Rogers Machine Co	Cover
Hyatt Roller Bearing Co.	28
Ingersoll Milling Machine Co.	36
Jenkins Bros.	Cover
Johnson Co., The	36
Johns Mfg. Co., H. W.	Cover
Jones & Co., B. M.	33
Jones & Lamson Machine Co.	Cover
Kelly & Jones Co., The	39
Keuffel & Esser Co.	40
Keystone Engine and Machine Works	40
King Mfg. Co.	36
Landis Bros	38
LeCount, Wm. G.	36
Leland & Faulconer Mfg. Co	31
Lodge & Shipley Machine Tool Co.	Cover
Long & Allstatter Co.	32
Mason Regulator Co	34
McCabe, J. J	29
Miner & Peck Mfg. Co.	Cover
Montgomery & Co.	30
Morse Twist Drill & Machine Co.	31
Mossberg Mfg. Co.	34
National Chuck Co.	35
National Machinery Co.	31
National Pipe Bending Co.	37
New Doty Mfg. Co.	38
New Haven Mfg. Co.	27
Newton Machine Tool Works	37

Continued on page 29.



18-Inch Swing Engine Lathe.

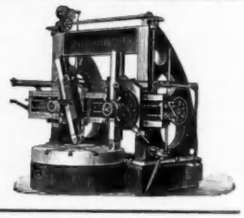
F. E. REED COMPANY,

WORCESTER, MASS.

Engine Lathes from 10 to 30 Inch Swing Inclusive.

MODERN MACHINE TOOLS

Constructed from designs embodying all the late improvements in economy, manipulation, strength and accuracy.



BETTS MACHINE CO., Wilmington, Del., U.S.A.

The Philosophy of Science

is ably presented by Prof. Ernst Mach in his recent work, "Popular Scientific Lectures;" cloth, gilt top, $1.00. (Send for circular No. 35.) Also by the same author in the January Monist,

The Part Played by Accident in Invention and Discovery.

With many other valuable contributions, 50 cents.

The Open Court Pub. Co., Chicago, 326 Dearborn St.

Do You Know

HOW to find what gears will cut that thread on ANY lathe—geared simple or compound,

AND your lathe wont cut every thread?

WHY MACHINE SHOP ARITHMETIC,

by Fred H. Colvin and Walter Lee Cheney, tells you in plain shop language all about screw cutting, making and using formulas, best speed for lathes, drills, taps, emery wheels, etc. Well bound—handy for pocket—50c.

PRACTICAL PUBLISHING CO., East Orange, N. J.

WRIGLEY'S EMERY WHEEL DRESSER

SENT ON TRIAL to responsible parties, to be returned or paid for in 30 days. Is a Tool for Facing, Shaping and General Work. Cutters are Self-Sharpening; Hardened steel-faced side bearings and steel bushed pin bearings. Price, $2.00 each; cutters 15 cts. per set. Send for circular.

THOS. WRIGLEY, 85-87 Fifth Ave., Chicago, U. S. A.

CHAS. CHURCHILL & CO., Ltd., London, Eng., Agents for Great Britain.

"A Machine Shop with modern equipment, heavy and light machinery, cranes of 20 tons capacity and 10,000 square feet of unoccupied floor space. Would contract to manufacture any kind of machinery."

Address: BOX 62, AMERICAN MACHINIST.

HYATT ROLLER BEARING CO.

NEW YORK OFFICE, 133 Liberty Street. NEWARK, N. J.

Flexible Steel Rollers for Reducing Friction. Steel Boxes for Hangers, and Pillow Blocks. Elastic Rollers for Loose Pulleys and Machinery in General.

FOR SALE, SECOND HAND ...

One 9 foot Niles Boring Mill. One 30 inch Stroke Drawing Press, Farrell. Two Drop Hammers, Farrell make. One Universal Radial Drill. One Reducing Press, Blake & Johnson. Four Fly Wheel Punches. One 1500 pound Stiles Drop Hammer. One 2 Spindle Profile Machine, P. & W. One Thread Rolling Machine.

And other good second-hand machinery.

W. H. ROBERTSON, 54 S. Canal St., Chicago.

SECOND-HAND TOOLS.

One 17"x 8 Lincoln B. G. S. C. Lathe.
One 15"x 5' Am. T. & M. Co. Square Arbor Lathe.
One 16"x 6' Am. T. & M. Co. Turret Lathe.
One 15"x 5' Square Arbor Fox Lathe.
One 18" B. G. P. F. Drill.
One 15"x 6' P. & W. Hand Lathe, with Slide Rest.
One Stewart Hand Lathe, C. S. and Foot Power.
One Water Tool Grinder & Pump.
One Marking Machine.

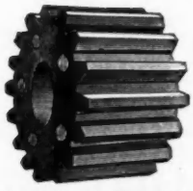
Dwight Slate Machine Co.,
HARTFORD, CONN.

CORRECT PROPORTIONS PRYBIL HANGERS GET A BOOKLET.

STRANGE, BUT TRUE!!

THE NEW PROCESS RAW HIDE GEARS

ASTONISH THE
MACHINERY WORLD.



They **Outwear any Metal.**

They require **No Lubricant.**

They are **Noiseless and Clean.**

NEW PROCESS RAW HIDE CO.,
PATENTEES AND SOLE MANUFACTURERS,
SYRACUSE, N. Y., U. S. A.

NEW BICYCLE TOOLS

WITH LATEST IMPROVEMENTS IN STOCK ...

HUB MACHINES "New Features"

SCREW MACHINES
For Cups and Cones.
No. 4. Friction Head, Wire Feed.
No. 3. With Wire Feed.
No. 2. With Wire Feed.

MILLING MACHINES
For Sprockets and Fittings.
"Universal" For Tools.

DRILLING MACHINES
For Frames.

LATHES For Tools and Regular Work.

SHAPERS, PRESSES, GRINDERS, ETC.

AGENCIES
G. A. GRAY CO., "PLANERS."
FITCHBURG MACHINE WORKS, "LATHES."
KEMPSMITH MACHINE TOOL CO., "MILLING MACHINES."
BARDENS & OLIVER, "SCREW MACHINES."
CLEVELAND PUNCH AND SHEAR WORKS, "BOILER AND BRIDGE TOOLS."

J. J. McCABE ....

Successor to E. P. Bullard's New York Machinery Works.
14 DEY STREET, NEW YORK.

MACHINERY BARGAINS

BEFORE REMOVAL At Phoenix Iron Works, Trenton, N. J.

29 in. x 13 1-2 ft. Engine Lathe.
26 " 20 " " "
37 " 30 " " "
51 " 18 " " "
19-36 and 50 in. Drills.

Portable Drill.
36 in. x 14 ft. Planer.
12 in. Shaper Traverse Head.
Gear Cutter, 54 in.
Milling Machine.

10 ft.-16 ft. Vertical Boring and Turning Mill, Cranes, Blower, Boiler Rolls, Punch and Shear, etc.

Send for FULL LIST and Prices.

GEORGE PLACE MACHINE CO.
145 Broadway and 86 Liberty St.,
NEW YORK.

MACHINERY FOR SALE.

28 in. x 24 in. x 7 ft. New Haven Planer. New.
21 in. Gould & Eberhardt Drill. Good as new.
6 in. Boynton Hand Shaper. " " "
1-4 to 1 1-4 in. Open-die Bolt Cutter, Good as new.
Nos. 1, 3 and 6 Roots Pressure Blowers. A1 condition.
9 x 9 Greenfield Upright Engine. Good as new.
18 x 5 x 10 Brass Lined Duplex Pump.
12 x 18 Slide Valve Engine.
Lot 6 1-2 in. and 7 1-2 in. Hammered Steel Shafting.
Bearings, Friction Clutch Pulleys, etc., less than half value.
COOKE & CO.,
163 and 165 Washington Street, New York.

OUR FIRE

DOES NOT INTERFERE WITH THE FILLING OF OUR ORDERS JUST AS USUAL, AS OUR

Store, Storeroom
AND
Annex Factory

WERE ALL UNINJURED BY THE FIRE; SO WE ARE WELL SITUATED TO TAKE CARE OF OUR CUSTOMERS' WANTS.

The Garvin Machine Co.,
LAIGHT AND CANAL STREETS,
NEW YORK.

Also, 51 North 7th Street, Philadelphia, Pa.

Second-Hand Machinery.

LATHES.

1 12 in. x 5 ft., Young.
1 13 in. x 5 ft., Lathe & Morse.
1 No. 39 S., 14 in. x 5 ft. 6 in., Harris.
1 No. 38 S., 15 in. x 6 in., Harris.
1 15 in. x 6 ft., Blaisdell.
1 15 in. x 6 ft., P. & W.
1 No. 18 C., 18 in. x 6 ft., L. & D., Compound Rest & Taper Attachment.
1 No. 19 C., 18 in. x 6 ft., L. & D., Compound Rest & Taper Attachment.
1 No. 20 C., 18 in. x 6 ft., L. & D., Compound Rest & Taper Attachment.
1 19 in. x 6 ft., Heavy F.
2 20 in. x 11 ft., Lathe & Morse.
1 No. 37 S., 20 in. x 10 ft., Lincoln.
1 No. 3 C., 21 in. x 10 ft., P. & W., Taper.
1 No. 6 C., 22 in. x 9 ft., P. & W., Taper.
1 No. 5 C., 22 in. x 10 ft., Niles, Taper.
1 No. 25 S., 23 in. x 10 ft., J. D. White, Taper.
1 24 in. x 16 ft., Nicholson & Waterman.
1 26 in. x 10 ft., Dustin & Hubbard.
1 No. 49 S., 27 in. x 12 ft., Wood & Light.
1 No. 50 S., 28 in. x 12 ft., Wood & Light.
1 No. 9 S., 28 in. x 16 ft., Wood & Light.
1 30 in. x 12 ft., Lathe & Morse new.
1 No. 44 S., 30 in. x 14 ft., Lincoln.
1 No. 45 S., 32 in. x 13 ft., Bement & Dougherty.
1 No. 46 S., 36 in. x 19 ft., Lincoln.
1 No. 19 S., 40 in. x 16 ft., Wood & Light.
1 No. 61 S., 48 in. x 18 ft., Gay & Silver.

PLANERS.

1 B., 20 in. x 20 in. x 4 ft., Fitchburg.
1 No. 10 S., 24 in. x 24 in. x 4 ft., Wood & Light.
1 No. 11 S., 24 in. x 24 in. x 4 ft., Wood & Light.
1 No. B., 24 in. x 24 in. x 4 ft., Pond, Mch. Tool Co.
1 No. B., 24 in. x 24 in. x 4 ft., Pond, Mch. Tool Co.
1 No. B., 24 in. x 24 in. x 5 ft., Pond, Mch. Tool Co.
1 No. 51 S., 24 in. x 24 in. x 5 ft. 6 in., Wood & Light.
1 H., 24 in. x 24 in. x 6 ft., Lathe & Morse.
1 No. B., 26 in. x 26 in. x 6 ft., Pond, Mch. Tool Co.
1 No. 16 S., 28 in. x 28 in. x 8 ft., Gay & Silver, Heavy.
1 No. 14 S., 32 in. x 32 in. x 10 ft., Wood & Light.
1 No. B., 36 in. x 36 in. x 9 ft., New Haven.
1 No. P., 36 in. x 36 in. x 9 ft., English.
1 No. B., 36 in. x 36 in. x 10 ft., Pond, Mch. Tool Co.
1 No. P., 36 in. x 36 in. x 14 ft., Powell.
1 No. 13 S., 38 in. x 38 in. x 10 ft., Aldrich & Co.
1 No. 17 S., 52 in. x 10 ft., Van Horn, Open Side Planer.
1 No. 127 C., 48 in. x 32 in. x 8 ft., Pond, Mch. Tool Co., 2 heads.
1 No. 128 C., 48 in. x 32 in. x 6 ft., Pond, Mch. Tool Co., 2 heads.
1 No. 129 C., 48 in. x 32 in. x 6 ft., Pond, Mch. Tool Co., 2 heads.
1 No. 130 C., 48 in. x 32 in. x 6 ft., Pond, Mch. Tool Co., 2 heads.
1 No. H., 60 in. x 60 in. x 15 ft., Niles Tool Works Co., 3 Heads.
1 No. W., 60 in. x 60 in. x 22 ft., Hepworth, 1 head.

Also large stock of other tools. Send for List.

Eastern Branch Niles Tool Works Co.,
136 and 138 Liberty St., New York City.

INDEX TO ADVERTISERS—Continued.

	PAGE
New Process Raw Hide Co	29
Nicholson File Co	34
Niles Tool Works Co	Cover
Niles Tool Works Co., N. Y. Branch	29
Norton Emery Wheel Co	31
Oneida Mfg. Chuck Co	35
Open Court Publishing Co	28
Orr & Sembower	40
Otto Gas Engine Works	40
Passaic Smelting and Refining Co.	37
Peerless Drilling Compound Co., The	30
Penberthy Injector Co	38
Pierce Engine Co	31
Place Machine Co., George	29
Practical Publishing Co	28
Pratt & Whitney Co	27
Pratt Chuck Co	35
Pryibil, P	32
Quint, A. D	33
Q. and C. Co	33
Reed Co., F. E	28
Robertson, W. H	29
Roth Bros. & Co	40
Roots, P. H. & F. M	Cover
Saunders' Sons, D	36
Sawyer Tool Co	31
Scott, Wm. P	25
Sebastian Lathe Co	33
Sebastian-May Co	36
Sellers & Co, Inc., Wm	Cover
Seneca Falls Mfg. Co	30
Shriver & Co., T	32
Skinner Chuck Co	35
Slocomb & Co., J. T	25
Standard Tool Co	38
Stark, John	37
Starrett, L. S	37
Stiles & Fladd Press Co., The	30
Sterling Emery Wheel Mfg. Co	38
Stirling Co., The	39
Stover Novelty Works	32
Strelinger & Co., Chas. A	32
Sturtevant Co., B. F	36
Taunton Locomotive Mfg. Co	37
Taylor-Rice Engineering Co	36
Timolat, J. G	40
Toomey, Frank	30
Trenton Iron Co., The	Cover
Trump Bros. Machine Co	35
Van Nostrand Co., D	25
Wagner & Andreas	30
Warner & Swasey	Cover
Waterbury-Farrel Foundry & Machine Co.	Cover
Waterbury Machine Co., The	37
W. & S. Hydraulic Machinery Works	35
Watts-Campbell Co	40
Wedderburn & Co., John	Cover
Wells Bros. & Co	Cover
Weston Engine Co	40
Whiton Machine Co., D. E	35
Wiley & Sons, John	27
Wiley & Russell Mfg. Co	27
Wilkinson Co., The	37
Wilkinson & Co., A. J	33
Wilson, W. A	40
Wirt, Chas	25
Wolverine Motor Works	36
Worcester Machine Screw Co.	33
Worthington, Henry R	35
Wrigley, T	28
Wyke & Co., J	30
Wyman & Gordon	Cover
Young Mfg. Co., W. C	39

Buyers' Finding List.

Adding Machines.
Grant Calculating Machine Co., Lexington, Mass.

Air Compressors.
Rand Drill Co., New York.

Anti-Friction Metal.
Passaic Smelting & Refining Co., Passaic, N. J.

Balls, Steel.
Cleveland Machine Screw Co., Cleveland, O.

Belt Dressing.
Dixon Crucible Co., Joseph, Jersey City, N. J.

Bench Screws.
Capital Machine Tool Co., Auburn, N. Y.

Bicycle Pumps.
Capital Machine Tool Co., Auburn, N. Y.

Bicycle Tools.
Bliss, E. W., Brooklyn, N. Y.
Brown & Sharpe Mfg. Co, Providence, R. I.
Cleveland Mach. Screw Co., Cleveland, O.
Davis & Egan Mach. Tool Co., Cincinnati, O.
Ferracute Machine Co., Bridgeton, N. J.
Garvin Machine Co., New York.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
Niles Tool Works Co., Hamilton, O.
Pratt & hitney Co., Hartford, Conn.
Wilkinson Co., The, Chicago, Ill.

Blowers.
American Gas Furnace Co., New York.
Buffalo Forge Co., Buffalo, N. Y.
Cooke & Co., New York.
Roots, P. H. & F. M., Connersville, Ind.
Sturtevant Co., B. F., Boston, Mass.

(Continued on page 30.)

BUYERS' FINDING LIST—Continued.

Boilers, Steam.
Orr & Sembower, Inc., Reading, Pa.
Sterling Co., The, Chicago, Ill.
Watts-Campbell Co., Newark, N. J.
Weston Engine Co., Painted Post, N. Y.

Bolt Cutters.
Acme Machinery Co., Cleveland, O.
Dawson & Goodwin, Chicago, Ill.
Detrick & Harvey Machine Co., Baltimore, Md.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
National Machinery Co., Tiffin, O.
Pratt & Whitney Co., Hartford, Conn.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Strelinger & Co., Chas. A., Detroit, Mich.
Wells Bros. & Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Books.
Audel & Co., Theo., New York.
Baird & Co., Henry Carey, Philadelphia, Pa.
Comstock, Wm. T., New York.
Grant, Geo. B., Lexington, Mass.
Henley & Co., Norman W., New York.
Open Court Publishing Co., Chicago, Ill.
Practical Publishing Co., East Orange, N. J.
Strelinger & Co., Chas. A., Detroit, Mich.
Wiley & Sons, John, New York.

Boring and Turning Mills.
Betts Machine Co., Wilmington, Del.
Bullard Machine Tool Co., Bridgeport, Conn.
Niles Tool Works Co., Hamilton, O.
Sellers & Co., Inc., William, Philadelphia, Pa.

Bushings.
New Process Raw Hide Co., Syracuse, N. Y.

Calipers.
Brown & Sharpe Mfg. Co., Providence, R. I.
Standard Tool Co., Athol, Mass.
Starrett, L. S., Athol, Mass.
Strelinger & Co., Chas. A., Detroit, Mich.
Wilkinson & Co., A. J., Boston, Mass.

Castings, Iron.
Builders Iron Foundry, Providence, R. I.
Burr & Houston Co., Brooklyn, N. Y.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Shriver & Co., T., New York.

Castings, Steel.
Johnson Co., The, Johnstown, Pa.

Centering Drill.
Slocomb & Co., J. T., Providence, R. I.

Chucks, Drill.
Almond, T. R., Brooklyn, N. Y.
Cushman Chuck Co., Hartford, Conn.
Dawson & Goodwin, Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Oneida Mfg. Chuck Co., Oneida, N. Y.
Pratt Chuck Co., Clayville, N. Y.
Skinner Chuck Co., New Britain, Conn.
Trump Bros. Machine Co., Wilmington, Del.
Wiley & Russell Mfg. Co., Greenfield, Mass
Whiton Machine Co., D. E., New London, Conn.

Chucks, Lathe.
Cushman Chuck Co., Hartford, Conn.
Dawson & Goodwin, Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
National Chuck Co., New York.
Oneida Mfg. Chuck Co., Oneida, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Pratt Chuck Co., Clayville, N. Y.
Skinner Chuck Co., New Britain, Conn.
Whiton Machine Co., D. E., New London, Conn.

Clutches, Friction.
Brown, A. & F., New York.
Evans Friction Cone Co., Boston, Mass.
New Haven Mfg. Co., New Haven, Conn.

Comptometers.
Felt & Tarrant Mfg. Co., Chicago, Ill.

Computers.
Cox Computer Co., New York.

Condensers.
Conover Mfg. Co., New York.
Worthington, Henry R., Brooklyn, N. Y.

Counting Machines.
Durant, W. N., Milwaukee, Wis.

Cranes.
Harrington, Son & Co., E., Philadelphia, Pa.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

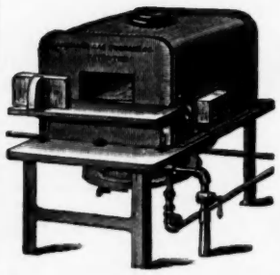
Cutting-Off Machines.
Armstrong Mfg. Co., The, Bridgeport, Conn.
Hill, Clarke & Co., Boston, Mass.
Hurlbut-Rogers Mach. Co., So. Sudbury, Mass.

Damper Regulators.
Hine & Robertson Co., New York.

Dies, Screw Cutting.
Acme Machinery Co., Cleveland, O.
Besly & Co., Chas. H., Chicago, Ill.
Carpenter, J. M., Pawtucket, R. I.
Detrick & Harvey Machine Co., Baltimore, Md.
Jones & Lamson Machine Co., Springfield, Vt.
Montgomery & Co., New York
Pratt & Whitney Co., Hartford, Conn.
Strelinger & Co., Chas. A., Detroit, Mich.
Taylor-Rice Engineering Co., Gloucester City, N. J
Wiley & Russell Mfg. Co., Greenfield, Mass.

Drawing Instruments, Etc.
Alteneder & Sons, T., Philadelphia, Pa.
Keuffel & Esser Co., New York.

Continued on page 31.



AMERICAN GAS FURNACE CO.,

Oil Gas Plants

GAS BLAST FURNACES AND HIGH PRESSURE BLOWERS

For the economical generation and systematic application of HEAT

CATALOGUES ON APPLICATION.

No. 80 Nassau St., NEW YORK.

English Agency: {Chas. Churchill & Co., Ltd., 21 Cross St., Finsbury, London, E. C., England.

Star Lathes

Foot-power Screw Cutting
Automatic Cross Feed
9 and 12 inch Swing.
New Designs. Novel Features.
Send for Catalogue B.
SENECA FALLS MFG. COMPANY
687 Water St., Seneca Falls, N. Y.

ONE CENT PER GALLON will cover the expense of making A Perfect Substitute for "Cutting Oil," now being used in Drilling, Threading, Punching, Planing or Milling Iron or Steel, by leading machinists. THE PEERLESS DRILLING COMPOUND is guaranteed not to rust, gum or clog machinery or to injure the hands, and is shipped on trial, without expense, to responsible parties. Send for our "Yard of Unsolicited Testimonials" and further particulars.

Address, THE PEERLESS DRILLING COMPOUND CO., 850-852 GENESEE ST., UTICA, N. Y.

Drop Hammers, Presses, Special Mach'y Dies.

THE STILES & FLADD PRESS CO.,

WATERTOWN, N. Y.

MACHINISTS' SCALES,

PATENT END GRADUATION.

We Invite Comparison for Accuracy with all others.

EVERY SCALE GUARANTEED. SEND FOR LIST.

COFFIN & LEIGHTON, SYRACUSE, N. Y.

Norwich Emery Wheels.

High Grade. Reasonable Price.

Address,
MONTGOMERY & CO.,
105 Fulton Street, New York City.

Bargains in New and Second-Hand Machinery.

72 inch, 57 inch, 26 inch and 24 inch Planers, and 36 inch and 50 inch Radial Drills.
36 inch x 22 feet Bement Lathe raised to 50 inch swing.
4 1-2 inch Pratt & Whitney Cut-off Machine.
No. 1 Brown & Sharpe Universal Milling Machine.
Lathes, Shapers, Drill Presses, Pipe Machines, Bolt Cutters, Steam Hammers, Grinding Machines and General Machinery.
Stock constantly changing. Let me know your wants.
FRANK TOOMEY, 131 North 3d St., Philadelphia, Pa.

Solder without Rust

BY USING THE ELLIOTT
NON-CORROSIVE SOLDERING FLUID

SAMPLE POST-PAID 10 CENTS.

ELLIOTT CHEMICAL WORKS, Newton, Mass.

SEE the illustration in the March 12th issue of the AMERICAN MACHINIST of our

MULTIPLE SPINDLE LATHE

For Manufacturing Operations.

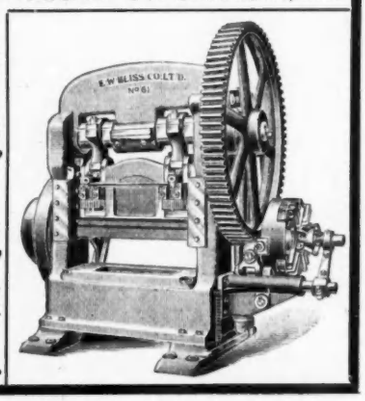
Correspondence Solicited.

WAGNER & ANDREAS,

LEIPZIG, GERMANY.

E. W. BLISS CO. 1 ADAMS ST., BROOKLYN, N.Y.

PRESSES, DIES, DROPS.



SOME DAY, PERHAPS,

—better appliances for Gear cutting than our plant boasts of may transpire. So far, however, they most certainly have not. Our equipment is distinctly modern, and embraces all that the exacting demands of such work requires for cutting Gearing, Spur, Bevel Miter, Spiral, and Worm, up to 50″ diameter and 8-inch face. All our Gears are cut with the "Brown & Sharpe" Patent Involute Cutters, and all are tested on special Gear-testing machines. Perhaps we might even be able to cut the cost of your cut Gearing for you?

LELAND & FAULCONER M'F'G CO.,
DETROIT, MICHIGAN.

NORTON EMERY WHEEL CO.
SEND FOR CATALOGUE
WORCESTER MASS.

CLEVELAND

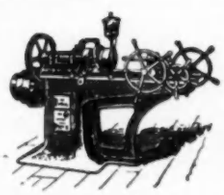
ESTABLISHED IN 1874.
CLEVELAND TWIST DRILL CO.
99 Reade Street, New York.
85 Queen Victoria Street, London, Eng.
5 Neue Promenade, Berlin, C., Germany.
Cor. Lake and Kirtland Streets, Cleveland, O.

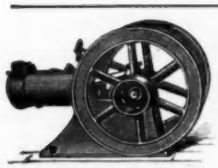
POLISHING WHEELS,
COVERED WITH HEAVY OAK-TANNED LEATHER.
Write for price list with discount, and list of sizes carried in stock.
BUILDERS IRON FOUNDRY,
PROVIDENCE, R. I.

MORSE TWIST DRILL AND MACHINE COMPANY,
Manufacturers of Morse Patent Straight-Lip Increase Twist Drills. New Bedford, MASS.

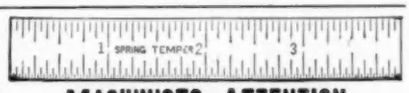
Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

BOLT and NUT MACHINERY.
WRITE FOR CATALOGUE AND PRICES.
Bolt Cutters, Pointers, Headers, Nut Tappers, Nut Machines, Upsetting and Bending Machinery, Washer Machines, Wire Nail Machinery, Hand and Automatic Spike Machines, Car Link and Pin Machinery.
The NATIONAL MACHINERY CO.
TIFFIN, OHIO.





WANT POWER?
The PIERCE Gas and Gasoline Engine is the best and most economical. Address,
PIERCE ENGINE CO., 19 Racine Street, Racine, Wis.



MACHINISTS, ATTENTION.
To introduce, will send post-paid on receipt of $1.60, one each of 3, 6 and 12 inch rules, all guaranteed equal to any in the market. Offer good until April 1. No stamps.
SAWYER TOOL CO., Athol, Mass.

BUYERS' FINDING LIST—Continued.

Drilling Compound.
Peerless Drilling Compound Co., The, Utica, N. Y.

Drilling Machines.
Aurora Tool Works, Aurora, Ind.
Barnes Co., W. F. & John, Rockford, Ill.
Baush & Sons, C. H., Holyoke, Mass.
Betts Machine Co., Wilmington, Del.
Bickford Drill & Tool Co., Cincinnati, O.
Blaisdell & Co., P., Worcester, Mass.
Dallett & Co., Thos. H., Philadelphia, Pa.
Davis, W. P., Rochester, N. Y.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Dietz, Schumacher & Co., Cincinnati, O.
Dwight Slate Machine Co., Hartford, Conn.
Fitchburg Machine Works, Fitchburg, Mass.
Fox Machine Co., Grand Rapids, Mich.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., E., Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Montgomery & Co., New York.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Works, Philadelphia, Pa.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Quint, A. D., Hartford, Conn.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Stover Novelty Works, Freeport, Ill.
Strelinger & Co., Chas. A., Detroit, Mich.
Timolat, J. G., New York.
Warner & Swasey, Cleveland, O.
Wilkinson & Co., A. J., Boston, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Drill Gage.
Wyke & Co., J., East Boston, Mass.

Drill Rods.
Abbott, Wheelock & Co., Boston, Mass.

Drills, Twist.
Besly & Co., Chas. H., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, O.
Montgomery & Co., New York.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drop Forgings.
Billings & Spencer Co., Hartford, Conn.
Wyman & Gordon, Worcester, Mass.

Dynamos.
Roth Bros. & Co., Chicago, Ill.

Dynamo Brushes.
Wirt, Chas., Philadelphia, Pa.

Elevators.
Albro-Clem Elevator Co., Philadelphia, Pa.

Emery Wheels.
Besly & Co., Chas. H., Chicago, Ill.
Diamond Machine Co., Providence, R. I.
Montgomery & Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Strelinger & Co., Chas. A., Detroit, Mich.
Sterling Emery Wheel Co., Tiffin, O.

Emery Wheel Dresser.
Wrigley, Thos., Chicago, Ill.

Engines, Gas and Gasoline.
Otto Gas Engine Works, Philadelphia, Pa.
Pierce Engine Co., Racine, Wis.
Wolverine Motor Works, Grand Rapids, Mich.

Engines, Steam.
Ames Iron Works, Oswego, N. Y.
Buffalo Forge Co., Buffalo, N. Y.
Forbes & Co., W. D., Hoboken, N. J.
Frick Co., The, Waynesboro, Pa.
Keystone Engine & Mach. Works, Phila., Pa.
Orr & Sembower, Inc., Reading, Pa.
Watts-Campbell Co., Newark, N. J.
Weston Engine Co., Painted Post, N. Y.

Feed Water Heaters and Purifiers.
Hine & Robertson Co., New York.
National Pipe Bending Co., New Haven, Conn.
Taunton Locomotive Mfg. Co., Taunton, Mass.

Files.
Besly & Co., Chas. H., Chicago, Ill.
Montgomery & Co., New York.
Nicholson File Co., Providence, R. I.
Strelinger & Co., Chas. A., Detroit, Mich.

Forges.
Buffalo Forge Co., Buffalo, N. Y.
Wilkinson Co., The, Chicago, Ill.

Friction Cones.
Evans Friction Cone Co., Boston, Mass.

Furnaces.
American Gas Furnace Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.

Gages.
Brown & Sharpe Mfg. Co., Providence, R. I.
Coffin & Leighton, Syracuse, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Taylor-Rice Engineering Co., Gloucester City, N. J.
Wyke & Co., J., East Boston, Mass.

Gear Cutters.
Brainard Milling Machine Co., Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gould & Eberhardt, Newark, N. J.
Grant, Geo. B., Lexington, Mass.
Hill, Clarke & Co., Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Whiton Mach. Co., D. E., New London, Conn.

Continued on page 32.

BUYERS' FINDING LIST—Continued.

Gears.
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Works, Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Grant, Geo. B., Lexington, Mass.
New Process Raw Hide Co., Syracuse, N. Y.
Shriver & Co., T., New York.

Graphite.
Dixon Crucible Co., Joseph, Jersey City, N. J.

Grinders, Center.
Barker & Co., William, Cincinnati, O.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Trump Bros. Machine Co., Wilmington, Del.

Grinding Machines, Universal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Landis Bros., Waynesboro, Pa.

Grinding and Polishing Machines.
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders Iron Foundry, Providence, R. I.
Diamond Machine Co., Providence, R. I.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Landis Bros., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
McCabe, J. J., New York.
Norton Emery Wheel Co., Worcester, Mass.
Place Machine Co., George, New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Strelinger & Co., Chas. A., Detroit, Mich.

Grinding Machine, Cutter.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Garvin Machine Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.

Hack Saws.
Besly & Co., Chas. H., Chicago, Ill.
Montgomery & Co., New York.
Q. & C. Co., Chicago, Ill.
Stover Novelty Works, Freeport, Ill.
Strelinger & Co., Chas. A., Detroit, Mich.

Hammers, Drop.
Long & Allstatter Co., Hamilton, O.
Miner & Peck Mfg. Co., New Haven, Conn.
Stiles & Fladd Press Co., Watertown, N. Y.
Pratt & Whitney Co., Hartford, Conn.

Hammers, Power.
Beaudry & Co., Boston, Mass.

Hoists.
Harrington, Son & Co., E., Philadelphia, Pa.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Hydraulic Machinery.
W. & S. Hydraulic Machinery Works, N. Y.

Injectors.
Hayden & Derby Mfg. Co., The, New York.
Jenkins Bros., New York.
Penberthy Injector Co., Detroit, Mich.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Jack Screws.
Capital Machine Tool Co., Auburn, N. Y.

Keyway Cutter.
Baker Bros., Toledo, O.

Lathes (see also Turret Lathes).
Barnes Co., W. F. & John, Rockford, Ill.
Blaisdell & Co., P., Worcester, Mass.
Brown & Sharpe Mfg Co., Providence, R. I.
Bullard Machine Tool Co., Bridgeport, Conn.
Davis, W. P., Rochester, N. Y.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Dietz, Schumacher & Co., Cincinnati, O.
Draper Machine Tool Co., Worcester, Mass.
Fifield Tool Co., Lowell, Mass.
Fitchburg Machine Works, Fitchburg, Mass.
Flather & Co., Nashua, N. H.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., E., Philadelphia, Pa.
Hendey Machine Co., Torrington, Conn.
Hill, Clarke & Co., Boston, Mass.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
McCabe, J. J., New York.
New Doty Mfg. Co., Janesville, Wis.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.
Sebastian Lathe Co., Cincinnati, O.
Sebastian-May Co., Sidney, O.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Stark, John, Boston, Mass.
Wagner & Andreas, Leipzig, Germany.

Milling Attachment.
Adams Co., The, Dubuque, Iowa.

Milling Cutters.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Erlandsen, J., New York.
Garvin Machine Co., New York.
Ingersoll Milling Machine Co., Rockford, Ill.
Reinecker, J. E., Chemnitz-Gablenz, Germany.
Starrett, L. S., Athol, Mass.

Milling Machines.
Bliss Co., E. W., Brooklyn, N. Y.
Brainard Milling Machine Co., Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.

Continued on page 33.

T. SHRIVER & CO.
333 East 56th Street, N. Y.
Iron and Brass Founders and Machinists

PULLEYS of any size, moulded on machine —no pattern needed.

GEARS of any diameter, face and pitch, made on Gear Moulding Machine—no pattern needed.

P. BLAISDELL & CO.,
Manufacturers of
Machinists' Tools,
WORCESTER, MASS.

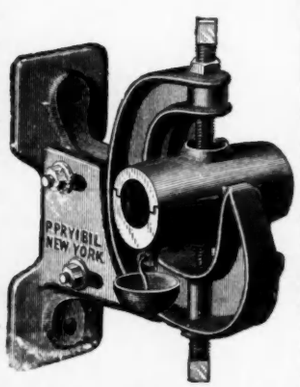
Stover Power Hack Saw and Friction Drills.

Saws made in two sizes Nos. 1 and 2. Cut 4½ to 8 inches. Send for circulars to
STOVER NOVELTY WORKS
Mfgrs. of Wood and Iron-Working Machinery
Special Machinery to order.
23 River St., FREEPORT, ILL., U. S. A.
C. W. BURTON, London, Eng.

HANGERS FOR THE TRADE.

Our boxes are reamed on a special machine which leaves the bearing exceedingly smooth and very accurate. They hold sufficient oil for three to six months. Durability and good workmanship **guaranteed.**

HANGERS



THIS SLIDING HOOK POST HANGER is adjustable in all directions—in and out, up and down. We have it in assorted sizes of diameter and reach. **Hangers of all styles** a specialty. We carry large stocks for immediate shipment. **Don't make hangers. It doesn't pay.** Get our **booklet** and discount and see for yourself.

NEAT DESIGNS. CORRECT PROPORTIONS.
ACCURATE WORKMANSHIP.

P. PRYIBIL,
512-524 WEST 41ST STREET, NEW YORK.
Telegrams "Pryibil, New York." A B C Code used.

The LONG & ALLSTATTER CO.
HAMILTON, OHIO.
DOUBLE, SINGLE, HORIZONTAL, TWIN, MULTIPLE AND AUTOMATIC SPACING.

SPLICE BAR PUNCH.
BELT, STEAM AND ELECTRICALLY DRIVEN
POWER PUNCHES AND SHEARS.

"There is but one suggestion we might make—and our desire to criticise would impel us to make more—if we could find anything to make criticisms about, and that is instead of calling this most neat, complete and comprehensive catalogue, 'A Book of Tools,' it should have been called *The* Book of Tools, for it has no equal."

F. E. REED & Co., Worcester, Mass.

"A Book of Tools" is our catalogue. It contains 550 pages, upwards of 2,000 illustrations, and will be sent post paid to any address upon receipt of 25 cents in stamps.

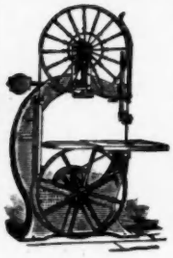
CHAS. A. STRELINGER & CO.
DETROIT, MICH.

FLEXIBLE STEEL TUBING.
For Conveying Oil or other Lubricant to and from Cutters, Drills, Etc.

Made of Steel and tinned Norway Iron. By far the best and neatest arrangement for Milling Machines, Bolt Cutters, Gun Boring Machines and other tools. Particulars given on application.

T. R. ALMOND,
83 Washington Street, Brooklyn, N. Y., U. S. A.

WOOD WORKING MACHINERY
OF EVERY DESCRIPTION.



CAR SHOP TOOLS
—AND—
PATTERN MAKERS MACHINERY,
LEADING SPECIALTIES.

Illustrative and Descriptive matter, with prices on application.

J. A. FAY & CO.,
293 to 313 W. Front St., Cincinnati, Ohio.